ON MEANS . . . FOR THE . . . . PROLONGATION OF LIFE . . . . . .

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FOR

THE PROLONGATION OF LIFE

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FOURTH ENLARGED EDITION, FOUNDED ON A LECTURE DELIVERED BEFORE THE ROYAL COLLEGE OF PHYSICIANS ON DECEMBER 3RD, 1903

BY

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Work, Moderation and Contentedness are the main sources of health, happiness and long life

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PREFACE TO THE FOURTH EDITION

This Fourth Edition contains some additions and alterations, but the arrangement of the whole remains unchanged. Further experience and communications from many of my friends and former patients confirm me in the correctness of the suggestions as to the manner of living contained in it. I claim no originality. Many of those who have written before me and since have given more or less similar advice. I specially mention a book which has appeared since the publication of the last edition of mine (1908), by Alfred von Lindheim, *Saluti Senectutis*, which contains much valuable information, and also Sir R. Douglas Powell's papers on "Advanced Life and its Diseases." I have myself carried out the rules laid down for others, with perseverance, for the last fifty years, as far as pressure of work allowed me to do. And now in my 91st year I possess good health and a fair amount of strength, and am able, to some degree, to watch the progress in my old profession, in science and art and social

matters ; and I still enjoy the beauties of Nature in my country walks, and above all things the intercourse with my children and their families and with old friends. It is often said that in old age affection and sympathy cease ; but this is not the rule, or at all events a rule with many exceptions.

HERMANN WEBER.

March, 1914.

PREFACE TO THE THIRD EDITION.

In publishing an enlarged edition of "Means for the Prolongation of Life," I have acted on some suggestions made to me by readers of the former editions. Thus I have added a short description of most of the more common articles of food, their digestibility and their *rôle* in the nutrition of the body. I have also divided the contents of the little treatise into a number of sections for easier reference; but I have otherwise left the arrangements and the greater part of the text as in the original lecture.

I have also endeavoured to make the Bibliography and the Index rather more complete.

Since the delivery of this lecture in 1903, several excellent communications on the same subject have appeared, by Sir Lauder Brunton, Professor Metchnikoff, Dr. William Ewart, M. Jean Finot, and others, from which I have derived much useful information.

Some of the advice given may be regarded as commonplace. This is true, but the secret

of success in life depends in most instances in acting on commonplace principles, and adapting them to the circumstances as they occur. This is especially the case in regard to maintaining health, preventing disease, and prolonging life.

During the years which have passed since the First Edition I have been strengthened in my views by intimations from many aged persons, who had carried out my advice for ten and twenty years, and more.

HERMANN WEBER.

June, 1908.

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ON MEANS FOR

THE PROLONGATION OF LIFE.

I.—Introductory.

The subject of the prolongation of life is a very large one, especially if considered with regard to the whole population from infancy onward.

The diminution of infant mortality and the improvement of the hygienic conditions of towns and houses have raised, and will continue to raise, the average duration of life. Here is a wide field of usefulness, and one of the most important sections of it will be the combat with the various forms of pathogenic microbes (Pflüger [106]), in which men like E. Jenner, Pasteur, Lister, Koch, and others have rendered immortal services to humanity. And besides, the greater cleanliness in all things, the improvement of dwellings and food supply to the labouring classes, and the hygienic and physical education of the entire population, which ought to commence in the nursery, and ought to be insisted

on at all schools, public and private, will not only contribute to the prolongation of life, but improve the whole race, so that our grandchildren ought not to hear any more of the deterioration of the physique of recruits and other candidates for the army and the professions and trades. By such means the resisting power of the organism to disease ought to be developed from an early period of life. The education, moral and physical, of each individual ought to lead to the development of the entire organism for the adequate performance of active work during a long period of mature life, followed by the period of old age, in fairly vigorous health with enjoyment of useful work, leading at last to the final period of gradual and painless cessation of the functions of life. We do not expect this evolution to be immediate ; but we must steadily work for its attainment from generation to generation. Dr. P. K. Pel, in an excellent address on the art of living long and happily, urges with justice that all school boys and girls ought to be taught how to maintain their health and to avoid injurious influences. This very promising subject will, however, scarcely be touched in the present discourse, which will relate principally to the prolongation of life by the arrangement of the

manner of living of adults. This more limited field of work deserves likewise our serious attention, since the death-rate of persons after about 55 or 60 has scarcely decreased during the last thirty or forty years, while that of children and adults below 45 is now considerably lower than it was then, as shown by the annual reports of the Registrar-General.

This lecture, I must premise, is principally a preventive contribution, and does not enter into the pathological anatomy so ably treated by Sir G. Humphry [60], and by Dr. Savill [115] in his interesting papers before the Medical Society in 1897, nor into the clinical symptoms sketched by Sir Clifford Allbutt [2, 3 and 4], by Dr. Savill, Dr. F. Parkes Weber [135], G. W. Balfour [10], Metchnikoff [80 and 81], and others ; nor shall I say much about the mental changes which have quite lately been discussed by Sir William Osler [98] and by the late Sir Samuel Wilks [144]. I shall only suggest a manner of living by which the senile changes may be postponed as long as possible, excluding in this discourse treatment by pharmaceutical remedies, and by organo- and serum-therapy.

I must also abstain from entering into the interesting subject of " comparative longevity,"

for which I may refer to the works of Buffon, Flourens, Sir E. Ray Lankester [70], and others, and restrict myself entirely to the longevity of man.

Much has been written on this subject from remote antiquity up to the present time. When I think, for instance, of Galen's "De Sanitate tuenda," Cicero's "De Senectute," Bacon's "Historia Vitæ et Mortis," Sir William Temple's chapter "of health and longevity," Hufeland's "Makrobiotik," Sir John Sinclair's "Code of Health" [120], Pel's [104], Pflüger's [106], Ebstein's [37], and many other good essays on this subject, it may look presumptuous that I address on it so learned a body; but the facts that I have occupied myself with it for more than half a century, and with a certain measure of success in others as well as myself, and that I may perhaps open up some fresh aspects, embolden me to place before you in a condensed form some of my experiences and views; and I am further moved to this course by an astonishing disregard of the means of prolonging life on the part of the public as well as the profession.

Since the delivery of this lecture in 1903, several excellent communications have appeared on prolongation of life, amongst which I may

mention Sir Lauder Brunton's address [18], Professor Ewald's [42], Dr. W. Ewart's [43], Professor Metchnikoff's very instructive and philosophical works [80 and 81], and Sir R. Douglas Powell's Lectures [108], as also M. Jean Finot's [44], A. Lorand's and A. von Lindheim's [73].

II.—Natural Duration of Life.

Before we consider how we can attain the natural term of life, we must say a few words about what we may regard as the *natural term*. The great ages attributed to the Hebrew patriarchs need not occupy us here. It is enough to point out that at the time of the Psalmist no such ages were reached, since he puts the limit at 70 and 80 years. This may at the present time still be considered the average term of life, but by careful arrangement of the manner of living this term may be increased in many persons endowed with good constitutions to 90 and 100, and occasionally to more, which we might call supernormal longevity, at least under present conditions, though in course of time it may become normal longevity. The difficulties of verifying the statements of great ages in past generations are very great, and due criticism has

not been exercised. Even the generally accepted great ages of Henry Jenkins, Thomas Parr, and the Countess of Desmond are, according to the investigations of Mr. W. Thom [124], to some degree mythical. We have no proof that these three persons reached the ages which are attributed to them, but Mr. T. E. Young [149] cites from the records of life assurance and annuity societies in England 7 cases of male and 15 cases of female lives having lived to between a hundred and a hundred and five years and eight months, a statement which we may receive as trustworthy ; but considering the very large number of insured lives among which these 22 cases of the duration of life beyond a hundred years have occurred (in 1902) we see that such a duration of life is excessively rare. Dr. Tatham, Superintendent of Statistics of the General Register Office, has kindly informed me that according to the census of 1901 there were, in the whole population of England and Wales, living above 90 years, 3,056 males and 6,482 females, in all 9,538 ; and above 100 years, 47 males and 99 females, in all 146. To the kindness of Mr. S. de Jastrzebski I owe the following figures from the census of 1911 :—

In *England* and *Wales*, with a population of 36,070,492, lived at :—

Years	Males	Females
90 to 95 ...	3,739 ...	7,821
95 „ 100 ...	505 ...	1,185
100 and over ...	36 ...	92

In *Scotland*, with a population of 4,760,902, lived at :—

Years	Males	Females
90 to 94 ...	522 ...	1,230
95 „ 99 ...	80 ...	249
100 and over ...	5 ...	19

In *Ireland*, with a population of 4,390,219, lived at :—

Years	Males	Females
90 to 95 ...	1,643 ...	1,989
95 „ 100 ...	443 ...	597
100 and over ...	133 ...	181

There is a striking difference in the proportion of people over 90 between England and Scotland on the one side, and Ireland on the other. It seems to be a fact that the number of old people in Ireland is comparatively greater, but it is also most probable that in Ireland there is a tendency to overstate the number of years in the higher ages.

To Dr. Parkes Weber I am indebted for the following statement about *France* for 1906 (" Résultats Statistiques du Recensement," 1906, Part 2) :—

	Males	Females	Total
Total population ...	19,099,721 ...	19,744,932	38,844,653
Living at or about 80	147,018 ...	215,161	362,179

In *Germany* 1900 :—

	Males	Females	Total
Population	27,737,247 ...	28,629,931	56,367,178
Living 90 to 95 ...	3,306 ...	5,571	8,877
95 „ 100 ...	329 ...	777	1,106
100 and over	8 ...	32	40

Sir Lauder Brunton, in his suggestive address on Longevity [18], states, on the authority of the Registrar-General, that during the last half-century a continuous increase of the average duration of life has taken place, from a little over 40 in 1854 to a little under 48 in 1900 ; but that in the decades from 60 to 90 years there is a slight diminution, and that this is also the case at the age of 100 in males, while there is a little increase in females. " The number of men living to 100 years per 100,000 of the population from 1891 to 1900 is only 7, and of women 24, as compared with 15 men and 36 women in 1838 to 1854." These figures may be, however, Sir Lauder fears, vitiated by the fact that there is a tendency to over-statement between the ages of 55 to 65, " a tendency which grows as the age advances, so that very little reliance can be put on the data of extreme ages." Much more reliance,

however, can be placed on the more recent figures.

There can be no doubt that circumstances which we may comprise by the term "environment" influence the duration of life. Those who live in crowded industrial districts; those who are obliged to share small and ill-ventilated rooms with many others; those who have to spend the whole day in confined factories, easily fall victims to infectious disease, or become sooner decrepit than those who live in the open air and sleep in well-aired rooms. Otherwise the nature of occupation or profession, provided there is nothing actually unhealthy in it, does not seem to exercise a very decided influence on longevity. The longevity, however, seems to be somewhat different in different countries. Thus, according to communications by Dr. Ormstein [97], a greater proportion of people reach high ages in Greece than in most other countries, a fact which already Lord Bacon had noticed; and Metchnikoff makes a similar statement with regard to the Balkans. This is probably due to the manner of living, climate and other environments. We know that in Norway, Denmark and Sweden the average duration of life is longer than in the South of Europe; and

Hufeland [59] mentioned already in the 18th century that life in colder regions is longer than in warmer; but that extremes of cold are not conducive to longevity.

It has been stated that some *races* are more long-lived than others. This is to some degree true, but much of the difference seems to depend on the manner of living, climate and other environments. There is, however, one race which is decidedly more long-lived than other races, namely, that of the *Jews*, unless they are living in the greatest poverty and in most unhygienic circumstances, as in Russia. In whatever climate they live, they are, as a rule, distinguished by comparative longevity. It may be that they were originally better constituted, but it appears almost certain that they have derived much benefit from their having obeyed during many centuries the wise hygienic and moral laws of Moses. Through this, we may assume, a kind of heredity for long life has been gradually developed. Dr. Jossé Johnson [65] has quite lately discussed this point before the Life Assurance Medical Officers' Association.

III.—Mode of Life of Long-lived Persons.

In examining the circumstances under which man is likely to reach the natural term of life, and especially the manner of living by which this end can be promoted, we must not allow ourselves to be deterred by the experience that some of the most long-lived persons have led injudicious lives. We may regard such occurrences as exceptions to the rule in persons endowed with specially good constitutions. After having carefully entered into the records of more than 150 cases of very long-lived persons, I have reason to say that by far the majority of them were temperate; were small meat-eaters; lived much in the open air; led an active life; many a life of toil, with great restrictions as to food and comforts; that most of them were early risers; that a great number of them had a joyful disposition, and performed their work cheerfully; and that only a few were intemperate or idle and lazy persons. We must keep before our eyes the means and circumstances by which the health of man is created and maintained, and those by which it is usually deteriorated, since the former are likely to promote, while the latter are almost sure to prevent,

longevity in the large majority of cases. Almost all those who have occupied themselves with the study of means tending to longevity have come to the conclusion that work and moderation belong to the most powerful of them.

We must, in laying down certain rules towards the promotion of a long life, and of a vigorous and happy old age, not be checked by the remarks which we constantly hear, that such rules are irksome, that it is preferable to live a short and enjoyable life than a long and tedious one with many restrictions; that it is not worth while to live to an old age full of suffering and of physical and mental weakness. No, we do not wish to prolong life merely for living long; but to prolong mental and bodily energy, and this with a measure of enjoyment and usefulness, and without bodily suffering. "*Non est vivere, sed valere vita.*" I have been in intimate relation with many distinguished persons, male and female, who reached old age. It is true that some of them were suffering, and that the mental faculties of most of them were somewhat impaired, when compared with the period of greatest vigour, but the majority had retained their interest in the development of science, in the evolution of social problems, and in the con-

dition of their own families and descendants; they were often able to give wise counsel, and to show the way to progress and success; they were eager to read and to learn, and never found a day too long. My friend Dr. Frank reminds me of the conversation on this subject between Socrates and Cephalus in Plato's "Republic," where Cephalus maintains that those who possess a well-regulated mind find old age no intolerable burden, but, on the contrary, are more happy in the mental repose and freedom from passions. Many of my own friends who had been pessimistic in their youth and early manhood have become optimistic in advanced life, attended by "hope, the kind nurse of old age."

I am convinced, from a large experience, that the manner of living required for the prolongation of life is irksome only at the beginning, that it becomes easy by habit and leads to health of mind and body, to increased usefulness, to freedom from suffering, and to happiness much greater than that to be obtained by yielding to the desire of indulgence in sensual or frivolous enjoyment. When I hear that a life of work and moderation is tedious, I am always reminded of the words of Fernando in "The Tempest":

> "And most poor matters
> Point to rich ends."

At first the regular walking and working and early rising may appear poor matters, and not less so the moderation, when one has to curb a good appetite before a richly covered table ; but then come the "rich ends" : health and happiness, and a long and happy life, full of activity, to terminate frequently by falling asleep without suffering.

It is a fallacy to think that those who indulge themselves by immoderate eating, drinking, and other sensual enjoyment can do so without the risk of great suffering often associated with unhappiness in advancing years. Experience, on the contrary, has shown us that the majority of those who have habitually indulged themselves do not die suddenly and easily in the midst of their enjoyment, but suffer often for months and years before death releases them.

Self-indulgence leads mostly to failure and unhappiness, *self-control* to success and happiness.

IV.—Heredity.

Amongst the circumstances connected with longevity the most prominent is *heredity*, which means an inherited good constitution. I have endeavoured to ascertain what are the principal

factors of this inherited longevity, whether it is to be ascribed more to one system of the body than to another. Almost all the aged persons whom I have examined with regard to this question seemed to have had an all-round good constitution ; all of them were, however, specially endowed, as far as I could learn, with a vigorous heart and good blood-vessels, and I am inclined to ascribe to the circulatory system the greatest share, though I know that the circulatory cannot be separated from the respiratory system and from the vaso-motor part of the nervous system. It is, as a rule, not the vigour of the muscular system which leads to longevity ; athletes and men with great muscular strength form no large percentage of the long-lived people ; nor does great intellectual power seem to be a prominent and general feature ; nor a strong digestive system, which, although useful when well managed, often gives rise to over-feeding, while a weak digestion compels moderation, and thus leads frequently to a longer life and happier old age than is obtained by those endowed with a strong digestive system.

The degree of health and strength at birth and in childhood does not always indicate the measure of health in later years and the duration

of life. It often occurs that of the children of the same parents, those strongest in childhood die earlier than the weaker ones, and that the weakest in infancy live longest. In my own experience two men who lived to above 90 were during their childhood so weak that it was said that they could not live to manhood, and that their lives were refused by insurance offices, while their brothers and sisters, who were regarded as much stronger, died much earlier. Amongst many well-known long-lived men, Voltaire and Goethe were considered weak in childhood.

The chances of a person belonging to a *long-lived family* are, *ceteris paribus*, much better than those of a person belonging to ordinary families, but it is a dangerous fallacy to rely too much on such a privilege. In a family well known to me, for instance, out of 11 children, whose parents (both) died above 90, 5 men and 4 women, leading satisfactory lives, lived to 88 and more, while 2 addicted to alcohol died between 60 and 70. In another family of 8 children, whose father had lived to 87, while the mother had reached the age of 96, only half of them, viz., 3 daughters and 1 son, lived beyond 86, while 3 sons and 1 daughter died under 70. The first

4 had lived judiciously, while of the 4 dying rather prematurely, two sons had over-indulged themselves with eating as well as drinking, one with drinking only, and the fourth, a daughter, having had a large family, became mentally depressed by frequent sources of grief and anxiety.

The tendency to *early death* is likewise hereditary in some families to such a degree that careful assurance offices refuse members of such families; but by judicious management, if commenced early enough, the life can be considerably prolonged in spite of the inherited tendency to early death, which seems to be mostly associated with a weak circulatory system.

We must endeavour to profit by the favourable influences of heredity, but counteract the unfavourable; we need not die at the same early ages as our forefathers did; we must not adhere to fatalism, or the idea that "what is decreed for us, cannot be altered," which is one of the worst doctrines; but we must trust in our own work, and in the truth of the proverb that "God helps those who help themselves." Most persons descended from short-lived ancestors have it in their power to prolong their lives by a judicious manner of living. I have a very

large experience before me showing the possibility of counteracting the inherited tendency to early death.

It seems to me a matter of importance to keep the idea of our power of influencing heredity constantly before our mind. In the same way as different hereditary varieties can be produced in animals and plants, hereditary tendencies to long life can, I think, be produced in man by protecting him from, or making him avoid, injurious influences—dietetic, climatic, hygienic, social, &c., and by substituting favourable for injurious influences. If this view were to be taken up generally, and acted upon, we might have, in the course of time, many long-lived and few short-lived families. Much, no doubt, can be done by physical education, great moderation and suitable occupation; but the most powerful influence would be exerted by well-selected marriages, and by preventing ill-suited ones; this, however, is, as yet, not in our power. Love is not generally influenced by considerations of health. The *Eugenics* Society, formed since this was written, may in course of many generations succeed in rendering the public more amenable to sacrifices necessary for the improvement of our race.

In advising persons with a hereditary tendency to rather early death, it is most important to become acquainted with their family history, the *causes of death of their parents and blood relatives*, since by combating the tendency to these causes of death, from as early a period as possible, we mostly succeed in prolonging life. This is conceded by the majority of medical men with regard to tuberculosis; but numerous deaths between 50 and 70, which are caused by the weakness of the fibres of the heart and of the coats of the arteries and capillaries, can be avoided, or, at all events, greatly retarded, by regular exercise, including walking, climbing and breathing exercises, and great moderation in food and alcohol; the tendency to atheromatous and allied changes, to arterio-sclerosis, to apoplexy and paralysis, by similar means; the tendency to diabetes and to gall-stones, by similar hygienic and dietetic measures; the tendency to senile bronchitis and pneumonia, which form so frequent causes of death in advanced life,[1] by much air out of doors and indoors, especially in the bedrooms, by respiratory

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[1] See the statistics in Dr. Savill's paper already quoted.

and other exercises tending to strengthen the heart and the lungs; the tendency to epilepsy and to certain forms of dipsomania which are allied to epilepsy, by total abstinence from youth onwards; and almost all other hereditary causes of early death can mostly be warded off by judicious arrangement of the manner of living. By appreciating the individual constitution, the tendencies to disease indicated by the family history, by the habit of the body, the occupation, &c., we are often able to prevent disease, and the *prevention of disease is one of the great means of prolonging life.* The progress of public hygiene will in this matter, we may hope, bear more and more fruit, but every single individual must in his own case endeavour to avoid exposure to disease and infection. We must endeavour to recognize all the weak points of the entire organism, and direct our attention to *strengthening these weak points. Above all things we must bear in mind* that moderation in food and *good air* in and out of doors are the most powerful factors in improving and maintaining health, and prolonging life. Two to three hours ought to be spent every day in the open air, and almost everyone, even delicate persons, can accustom

themselves to it. We have often heard from many persons the objection that they cannot bear much open air, that it causes with them catarrh, rheumatism, neuralgia and many other complaints, but most of these objectors became gradually convinced that they could accustom themselves to it, and that in many cases it was not the abundance of air which caused these troubles, but the injudicious and imperfect way in which they had exposed themselves to it; for instance, by small chinks in the windows instead of by fully opened windows, or by imperfectly closing doors, or by sitting between the door and the fireplace, or window and fireplace, or by driving in closed carriages with the window of one side partly open, instead of driving in an entirely open carriage or in an open bath-chair. Admitting the air through a small opening causes *draught*, which often produces in sensitive persons a local chill of the eye, the ear, the neck, or other parts, while by allowing the air to enter the room through fully open windows or doors, the body becomes soon accustomed to it, is strengthened, and gains in resisting power. It is scarcely necessary to add that I do not wish to recommend delicate persons to expose themselves all at once to a combination of cold

air with high wind, but gradually to accustom themselves to such habits.[1]

I could give a great many instances of persons who escaped the diseases of their parents and near relatives by well-adapted management. I will, however, only mention five, beginning with my own case, because you know me and see me before you.

Case 1.—My mother died before she was 60 from weakness of the heart, inherited from her father and grandfather, which led to frequent attacks of bronchitis and general dropsy; my father died likewise in his 60th year from cerebral apoplexy; he had not been an abstainer himself, and his forefathers, during four or five generations, had taken largely the strongest kinds of hock and

---

[1] The question of *living in good air* has many aspects. To mention only a few points, we ought not only to spend several hours every day in the open air, but the house we live in, if in town, ought to lie in a broad street or an open space, not in a narrow lane, shut out from sun and air; if in the country, not in a hollow surrounded by high hills, or in a deep valley, but on the brow or slope of a hill, well above the bottom, or in an open locality, fully exposed to the sun. The house itself must be constantly kept well aired; the windows of the bedroom must be open during the whole day and, in part at least, during the night. The beneficial influence which the acting on these rules exercises on health can scarcely be over-estimated; it is most marked in children, but hardly less so in adults and those far advanced in age.

port, and died from affections of gouty nature, including one of paralysis and one of apoplexy, mostly under 71 years of age. By moderation and abundant exercise of body and mind, including walking, climbing and breathing exercises, I have escaped death from these causes, have greatly prolonged my life, and am now in good health in my 91st year.

Case 2.—Nearly fifty years ago a gentleman consulted me, at the age of 41, who suffered from frequent attacks of bronchial catarrh, from weakness of the heart, was rather stout, had a sedentary occupation, took much meat, and was inclined to constipation and bleeding piles. His father had died from "chronic bronchitis with dropsy" at the age of 61, his paternal grandfather from "bronchitis and congestion of the lungs" at 64; while his mother, belonging to a rather short-lived family, had died from "pneumonia," aged 59. By means of great moderation in eating, especially of flesh food, and drinking, with attention to his bowels, by living much in the open air and in well-ventilated houses and rooms, by regular breathing exercises, abundant walking exercise and regular occupation, the tendency to bronchial catarrh, to constipation and piles disappeared, and he lived to the age of 75, when he succumbed to a severe attack of influenza. Three brothers and one sister, who had not followed out similar regimes, but had indulged themselves more or less, died before they were 60, from chronic diseases of the heart or of the respiratory organs.

Case 3.—In 1862 I was consulted by a gentleman, aged 44, whose father and grandfather had died

under 64 years of age from apoplexy; while his mother, who had belonged to a fairly long-lived family, had lived to 69. The patient, who was in the habit of eating and drinking largely, was of florid complexion, muscular, slightly above the average weight for his height, and had had two severe attacks of gout. He was induced to diminish the quantity of meat to a very small amount, and to take it only on two days in the week, to give up stimulants almost entirely, and to take much open-air exercise, in addition to daily breathing exercises, with the result that the attacks of gout ceased after some years, that his general health became perfect, and that he was able to enjoy the pleasures of intellectual and social work up to 78 years of age, when he began to show signs of weakness of the heart after an accident which prevented his continuing to take active exercise. The final cause of death was pneumonia. Two brothers and a sister of this gentleman, who had indulged their appetites and taken little active exercise, died between 60 and 66, from apoplexy, and others at earlier ages from bronchial attacks and failure of the heart.

We may fairly assume that life in Case 3 was considerably prolonged through his combating the family tendency to apoplexy and failure of the respiratory system and heart, by means of great moderation and much exercise; and the same may be said of the subject of Case 2 with regard to the inheritance of tendency to weakness of the heart and respiratory system.

Still more striking is the effect of the manner

of living in counteracting the hereditary tendency to early deaths in Cases 4 and 5.

Case 4.—A. C., a member of a family of five sons and five daughters, consulted me when aged 35, complaining of weakness, shortness of breath, especially after lunch, frequent sleepiness, particularly after meals. His family history was very grave. His father had died at 49 from bronchitis; his paternal grandmother at 55 from pneumonia; his paternal grandfather at 48 from "dropsy"; his mother had died suddenly at 52 from "failure of the heart"; his maternal grandfather at 51 from apoplexy; his maternal grandmother at 56 from "dropsy." His life had been refused by several insurance offices. The patient was a solicitor who took little exercise, lived freely in eating and drinking, and slept mostly over eight hours. The heart was feeble, the face was red from congested capillaries. I advised him to take meat or other fleshy food only once a day; to limit the stimulants to a quarter of a bottle of light hock or claret during the twenty-four hours, and the sleep to six hours. In addition, he was ordered to take breathing exercises every morning during a quarter of an hour, a hot bath followed by a cold shower, and to walk at least two hours a day. This manner of living led, within two months, to great improvement, after which the daily walking exercise was supplemented by a whole day's walking or shooting at least once a week. On this regime A. C. lived in good health up to the age of 74, when he died from influenza.

All the four brothers of A. C., who lived on the plan that they must "*sustain*" themselves by eating and drinking much, and avoid exertion in order to prevent "wearing out," died between 49 and 56 (one from failure of the heart, one from apoplexy, one after an operation for stone, one from cause unknown to me). Of the five sisters, three died from various diseases under 56, one from accident at 45; the fifth, who died at 75, is the subject of Case 5.

Case 5.—A married lady, aged 36, a sister of the subject of Case 4, consulted me on account of shortness of breath, œdema of the legs, and varicose veins. She had had four children, the youngest being 3 years old. Her heart was dilated; she was rather stout; the urine was normal. She was in the habit of eating rather largely and taking much water and soups at lunch and dinner. She took scarcely any exercise. She was ordered to take meat only once a day; no soup, nor other fluid at the two principal meals, but a small tumblerful of water night and morning; to begin with very gentle breathing exercises and two short walks every day in all weathers, and gradually to increase the amount of breathing and walking exercises. Within four weeks the œdema of the legs had disappeared, and after another month she was able to walk two hours every day. On this plan her health further improved and remained satisfactory up to the age of 70, when I lost sight of her; but I heard later that she had died at 75.

V.—Cause of Death from Old Age.

Death from *old age* is caused by a kind of *atrophy of the tissues and organs*, especially the cellular elements, connected with changes in the small blood-vessels and lymphatics. For the more accurate description of these senile changes I refer to Professor Humphry's classical work on "Old Age" [60]; to Professor Metchnikoff's English edition on "Prolongation of Life" [81] and "Etudes sur la Vieillesse" [82], and to the articles on "Old Age" in the second edition of Allbutt and Rolleston's "System of Medicine," by Dr. Parkes Weber [135]. We must counteract this tendency to *senile atrophy* by supplying the tissues and organs with healthy blood; and to do so we must endeavour to produce a healthy state of the blood and to maintain the blood-vessels and lymphatics in a sound and vigorous condition. Life, we may say, depends to a great extent on the state of the organs of circulation, including the heart, the small arteries, the capillaries and lymphatics, which latter have in old age a great tendency to obliteration; and our aim must be to keep the lymphatics, arterioles and capillaries in working condition, and to prevent or postpone as much as possible their degeneration or obliteration

by atheromatous and other changes connected with old age. The best way to effect this is by keeping the organs in *action*, while *inaction* leads to decay. We must therefore endeavour to maintain the former and to prevent the latter.

Professor Metchnikoff, in his philosophical and suggestive works, ascribes this decay to the action of macrophages, which name he gives to the larger kind of phagocytes, viz., cells which effect the absorption of exudation, and the destruction of hostile microbes. He maintains that these cells, useful as they are in absorbing hæmorrhages and exudations, are instrumental also in the changes of old age, that they surround the vital parts, the higher cells of the brain and other organs, the tubules of the kidneys, &c., that they absorb them and transform them into connective tissue, thus producing the fibrous degeneration of organs which is one of the main changes of senility. This explanation of senile decay does not in any way militate against the view that we must endeavour by all means in our power to keep up the nutrition and functions of all organs and tissues of the body by promoting the activity of the nutritive capillaries, since the macrophages attack decaying but not healthy tissues.

VI.—Action of Exercise on the Muscular System in general and especially on the Heart and Blood-vessels.

Everyone can observe on himself that the arms become weak and thin and their muscles flaccid, if they are not used, while they become strong, if they are properly employed. Exercise of a muscle causes increased nutrition of the muscle ; exercise of the different parts of the body, limbs and trunk, strengthens the whole muscular system, and this is of the greatest value to the entire organism, since the function of the muscular system is not only the motion of the body and its different parts, but also the production of heat and the promotion of metabolism.

The physiological processes connected with the all-important question, the *exercise of the organs*, have been studied by Ludwig and his pupils, including in this country especially Sir Lauder Brunton, and independently by Dr. George Oliver, formerly of Harrogate. During the action of the muscle its arterioles become widened, more blood flows into the capillaries and the lymph spaces ; thus more food and more oxygen are carried to the tissues, and at the same time the waste products are

removed. This has often been demonstrated on the muscle whose regular contraction causes increase in size and strength ; it is, however, not only the muscular fibre which gains, but the nutritive vessels and absorbents themselves gain equally much by being kept in action. The increased afflux of blood which is caused by the action of the muscle forces the small vessels to work, and to conduct more blood to the tissues, and thus their coats are maintained in a sound condition. At the same time the lymphatics are kept in action by the removal of the increased amount of fluid from the lymph spaces, containing the used-up material. Similar is the case with the brain and nerve centres ; the acts of thinking and of initiating movements in the voluntary muscles lead to afflux of blood to the nerve centres, to increased nutrition of the ganglion cells and nerve-fibres, and at the same time of the minute vessels, efferent as well as afferent. The increased afflux of blood to the brain by the act of thinking has been shown by the ingenious experiment of Mosso [86], one of Ludwig's pupils, who, as you know, has constructed a finely balanced table on which he placed a man in the horizontal position, and demonstrated

that during the act of thinking the head becomes heavier, so that the head portion of the table goes down.

The healthy condition of the *heart* and *blood-vessels*, which is necessary for maintaining the nutrition of the organs and tissues, is effected by keeping them in constant action. A certain amount of action is inherent to them without any effort of the will. This amount of inherent action varies considerably in different individuals. In some constitutions the system of circulation, and, through it, the health of the organs, remains satisfactory during a long life without any special stimulus; but in the majority it is apt to decay at a more or less early period of life, and these tendencies to early decay are, as already mentioned, in many families hereditary, and must be counteracted by judicious means.

If we review the different means in our power to prevent early decay and to keep the circulatory system in a healthy condition, we find that the most efficacious means are given by the different forms of *exercise*. Muscular exercise is one of the most powerful means of preventing *arterio-sclerosis* which Sir Lauder Brunton in his address on Longevity [18] calls "the great enemy to longevity."

The mode of action of *muscular exercise* Dr. George Oliver explains ingeniously in his address delivered before the British Balneological and Climatological Society in May, 1903. He has lately been making a large number of experiments on the effects of respiratory and muscular exercises on the blood-pressure and on the tissue lymph circulation, and he informs me "that all these exercises (respiratory and muscular) produce the same effect, namely: (*a*) A rise of blood-pressure, and an increase of tissue fluid during the continuance of the exercises; and (*b*) a rapid decrease and immediate fall of the pressure, and a diminution of the tissue fluid on the cessation of them"; and he has found "that the rise and subsequent fall in pressure and in tissue lymph are greater when these two forms of exercise —muscular and respiratory—are combined, than when one or the other is practised alone." He concludes "that exercise (whether respiratory or solely muscular, or both combined) stimulates the fluid exchange between the blood and tissue space." Sir Lauder Brunton, in his lecture on Atheroma [15], describes how each contraction of the muscle drives the fluid onward, and how with each relaxation its tissue

juice and products of waste are sucked into the lymph spaces and lymphatics. Thus amongst the effects of all forms of exercise, one of the most important is the promotion of the *removal of the waste products* of the tissues. Many chronic affections, such as gout, are caused by the imperfect removal of the waste materials.

Walking Exercise.—The most natural form of exercise is *walking*. By walking we all know the action of the heart and the breathing are accelerated; all the organs of circulation, including the coronary arteries, are exercised; more blood is passed into the blood-vessels of the body, which are obliged to contract more vigorously and carry it with greater energy to the different organs and tissues, nourish the latter and become themselves nourished by the work. At the same time the number and depth of inspirations are increased, more oxygen is taken up and more carbonic acid is given out, and the metabolism of the whole body is promoted. Walking also influences the action of the heart in another way; by the contractions of the muscles of the feet and legs more blood is attracted to them and all afferent vessels of the lower extremities carry to them more blood from the heart, and the efferent vessels, the veins and

lymphatics carry more blood and lymph back to the heart and force it to contract more energetically. The condition of the veins of the lower extremities is much improved by walking. Many persons have naturally weak veins, which are apt, owing to want of contractile power of their coats, to become distended and varicose, and under injurious influences, such as overfeeding, habitual constipation, goutiness, long-continued standing, &c., to become inflamed. Phlebitis and thrombosis of the veins of the legs are mostly due to such conditions and circumstances. Although much walking exercise is to be avoided, while the veins are inflamed or thrombosed, yet regular walking is one of the best means of prevention. The circulation of the blood and lymph in the abdominal cavity is likewise powerfully promoted by the act of walking; as well through the increased pumping action of the heart, as also by the increased contractions of the diaphragm and abdominal walls. All the organs of the abdominal cavity, including the sympathetic nervous system, share the improved state of the circulation. In addition to these effects of walking we must take into consideration the fluid exchange between the blood and the tissues explained by Dr. Oliver's observa-

tions previously mentioned. Another effect of walking, and of all muscular exercises, is the improvement of the nutrition of the muscles, and this in itself is a most important means of counteracting the natural tendency to decay; for the atrophy of the muscles is in most persons one of the first manifestations of senility, and is one of the main causes of the loss of weight, of the deterioration of the metabolism and the power of heat-production in aged people. Yet another effect of walking and other muscular exercise is a change in the distribution of blood in the body: the action of the muscles produces increased afflux of blood to them, by which blood is removed from the internal organs, and stagnation of blood in the latter is counteracted. This circumstance explains also an experience which many people of limited strength make on themselves, viz., that hard walking or other hard muscular exercise taken soon after meals disturbs their digestion. One of the causes of this is that the action of the voluntary muscles after meals attracts part of the blood which the stomach requires for its work.

Many persons, including men of literary occupations, even medical men, and many women, think that walking exercise is quite

unnecessary ; but the great majority of them suffer in later years from the neglect of this or other active exercises. The organization of man, the large lower extremities with which he is provided, show that they are destined for active use.

The *amount of walking* necessary and useful to maintain health varies widely in different persons and even in the same persons under different circumstances ; we may say from half an hour to two or three hours a day, and even more. We must consider as well what *can* be done, as what is *desirable*. This depends not only on the general strength of a person, but also on the varying state of health, on habit, on age, on the meteorological surroundings, such as heat or cold, humidity, movement or stagnation of air, on the clothing and other circumstances. What is only just sufficient for one is great excess to another, or to the same person under different circumstances. In persons unaccustomed to exercise a long walk or an active climb of some hours can produce an overstrain of the heart of grave import, while the same person after some training can make a similar exertion without any feeling of fatigue. The amount which is useful and possible must be judged by the

condition of the individual at the time being. *It ought not to be extended to the feeling of distress ;* a rule which holds good for all forms of exercise. We cannot lay too great stress on this point. We have repeatedly seen irretrievable harm and even death caused by hard walking, especially climbing in the Alps and in the mountains of Scotland and Wales, and by running and rowing matches, in persons who were in an untrained condition, while they had been able to undergo greater exertions six or twelve months before, when they had become accustomed to them by gradually increasing work.

When warning against real over-exertion, I must point out a feeling of false fatigue which not rarely occurs at the beginning of a walk, but disappears after a quarter or half an hour of active walking. We must distinguish this from real fatigue, and not yield to the desire to remain quiet.

As to the best *time of the day for walking*, the majority of strong persons can walk at all times and may therefore select the hours most convenient to them. Many *weak* persons feel that much walking just before or after the principal meals interferes with their digestion ; they ought to walk at intermediate times ; they also ought

to avoid much active exercise before breakfast, while for strong people an early morning walk is most useful and enjoyable. We must allude here to a common error, viz., that walking *by night* is to be avoided. The idea that night air is injurious to healthy persons is quite incorrect. Owing to this error many persons walk very little during winter, especially those engaged in offices. The insufficient amount of walking exercise and of stay in the open air is one of the principal causes why, during winter and early spring, the resisting power of so many people is diminished and why in consequence they fall a prey to frequent colds, to bronchitis, pneumonia, and other illnesses. Those who spend several hours by night or day in the open air are infinitely less liable to them than those who remain in confined rooms. Although the night air is colder, the cold can easily be resisted by warm clothing, and *moderately cold weather* exercises on healthy persons a tonic influence.

The *pace* of the walk likewise deserves consideration, and ought to be different in different individual conditions and under different circumstances. We hear sometimes that persons are told to walk two, or three, or four miles an hour, but no general rules can be laid down

excepting perhaps this, that the pace ought not to be so great as to cause palpitation of the heart or breathlessness, and, on the other side, ought to be quick enough to produce a gentle glow of the whole body. Here, again, *habit* is of great importance, and this ought to be acquired gradually, and not to be changed suddenly. When a person, accustomed to a rate of one or one and a half to two miles an hour, is induced by companions to walk four miles an hour or more, great harm is occasionally done. Stout persons, many of whom have weak hearts, ought, as a rule, not to walk fast ; a rule which holds also good for aged people ; but these rules are subject to many exceptions. It is sometimes laid down as a rule, that a person above 65 ought not to exceed two miles an hour, but by careful training a habit may be produced which allows a much quicker rate even at the age of 75 to 80 and more, *if all the organs are sound.* Whatever can be maintained by the aged, as well with regard to the pace as to the amount of exercise, ought to be maintained, but *exhaustion* ought to be avoided. Experience shows that *the condition of the organs is of greater importance than the number of years.*

It is beneficial to many people with a sound

heart occasionally to *run*, especially down hill, since by the act of running some sets of muscles are put into action which by mere walking are only slightly used ; all the abdominal organs are shaken by it, and the circulation in the whole body is much accelerated. Old persons are mostly forbidden to run ; but this, again, is a rule which admits of numerous exceptions. We ought certainly not to advise aged people who have had no run for many months to begin with a rapid run of five minutes ; but by commencing with a gentle run of one or two minutes they can, if their organs are sound, gradually increase the time and pace with great advantage to themselves.

It often occurs that persons advancing in years, after having been prevented by illness or other causes from taking their regular walks, feel fatigued when first resuming them, and infer from this that they are too old or too weak to take proper walks, and in consequence discontinue them, lose power and inclination, and actually become prematurely old. Whenever I succeeded in persuading such persons to commence with short walks and gradually increase them, they regained the habit of exercise, at least to a moderate degree, and postponed the senile decay. The same holds good with the giving

up of the exercise of the mind, or of professional or other work. To many persons the retiring from business or from work on acquiring a fortune or a pension is the cause of premature decay.

A remarkable instance of this class has occurred to me in a beggar who, having by an accident in childhood lost both legs, had acquired a little fortune by begging while wheeling himself about on a public promenade. He retired at the age of rather over 50 from this occupation and remained in his room or on his doorstep on most days from morning till night, but continued to take the amount of food he used to take during active exercise. He soon began to lose strength and vivacity and died within four years from apoplexy.

Walking exercises also a most beneficial influence on the *mind* and the *mental faculties*. *Leslie Stephen*, himself a great walker, says that most men of letters have been enthusiastic walkers. *Swift*, he thinks, was perhaps the first man to show a full appreciation of the moral and physical advantages of walking, and Leslie Stephen attributes to the fresh air exercise some of the spirit in *Wesley's* sermons. *Fielding* shows by one of his heroes, Parson Adams,

that he was an admirer of walking exercise. *Wordsworth* was a great walker, and his walks in beautiful scenery probably have inspired many of his poems. So were *Sir Walter Scott*, *Coleridge*, *Carlyle* and many others who owed to their love of walking much of their vigorous naturalism.

People in advanced age are unable to take as much exercise as those in middle age; but they ought to walk as much as they can, without actual fatigue, once, twice, or three times a day.

Although, as previously mentioned, we exercise by walking not only the muscles and blood-vessels of the legs, but influence by it almost all other parts, and all the tissues of the body and their component cells, including the brain cells, we ought also to practise movements of the *trunk*, the *arms*, and the *hands*. Most persons can combine this to some degree with the regular breathing exercises, and those who cannot ought to devote at least five to ten minutes or more once or twice every day to exercises of the trunk, the arms, and the hands. I ought to mention that it is important to exercise the *left* hand and arm as well as the right, since by neglecting the proper use of the left hand, a corresponding part of the right hemisphere of the brain is less perfectly nourished.

The thorough drying and rubbing after the morning bath affords already some exercise to the arms and trunk, and this can be augmented by further exercises of the arms, legs and trunk before dressing again. We shall return to this when speaking of the bath.

The *hands* of many persons do not receive sufficient attention. The stiffness and deformity of the hand and fingers, so often seen in advancing age, can be avoided almost entirely, by judicious exercise and massage of the fingers.

Those who possess fairly healthy organs of circulation derive more benefit from gentle *uphill exercise* than from walking downhill or on the level ground. Also in weakness of the muscular fibre of the heart and moderate degrees of dilatation, graduated uphill exercise has a most beneficial effect (Oertel). It is scarcely necessary to remark that these suggestions as to walking uphill and other exercises are not intended for convalescents from acute diseases, and least so from rheumatic fever with recent heart complications, excepting under careful supervision.

This regular walking exercise, provided the health is fairly good, ought not to be interrupted by so-called *bad weather;* it ought to be taken in all kinds of weather, rain or sunshine,

cold or warm, day or night. Many people with a tendency to rheumatism are excessively afraid that walking in rainy weather may cause fresh attacks of rheumatism or increase the rheumatic troubles from which they are already suffering, and on this account stay at home on damp and rainy days ; many with a chronic catarrh of the nose or throat or respiratory organs think and do the same ; but with proper protection by clothing, strong boots and umbrella, and changing the clothes at the end of the walk, this fear is unfounded, provided the rain is not combined with strong cold winds. The air is generally purer during and after rain than at other times. Almost all otherwise healthy persons become easily accustomed to every state of weather, and the tendency to rheumatism and catarrh from chills is either totally overcome by it, or at all events very much diminished, and the resisting power of the body is maintained and increased. When I asked Moltke, the great general, by what means he had maintained his health and activity, he answered : "By great moderation in all things ; by regular outdoor exercise in all weathers, good and bad ; never a whole day at home." He was in his ninetieth year at that

time. This rule, however, requires some modification for those whose resisting power is much weakened either by disease or by old age. They, or at all events many of them, ought not to expose themselves to the fogs or strong, cold winds often prevailing during winter and spring in most parts of Great Britain, but should either stay at home on the most inclement days and take extra indoor gymnastic and breathing exercises ; or, if they can afford it, spend those seasons in warmer and sunnier climates, or at one of the sheltered localities of the southern or south-western coasts of England or Ireland. These localities ought to be provided with numerous divided open shelters where invalids can sit for hours in the open air without being exposed to cold winds and rain.

Since walking is one of the principal means for health and long life, we ought to keep the *feet* in a sound condition. Many people neglect walking, because their feet become painful. The shoes ought to be of strong but not hard leather, ought to have thick soles, ought not to be too tight, but ought to fit easily and thoroughly in order to prevent corns and bunions. The same is the case with the socks or stockings ; folds and creases ought to be

carefully avoided, for they lead to corns and similar troubles.

Days of Prolonged Exercise.

It is of great use for those who are still in fair vigour to take regularly, once a week, *a day of more prolonged exercise*, up to three, four and six hours; and those who live in towns ought to spend this day of extra exercise in the country, if possible, on account of the purer air and the change of scene. The benefit of such a long walk is increased if only a very small quantity of food and fluid is taken during the walk; for instance, a sandwich or a few plain biscuits, and an apple or an orange. This is an important matter, for if much food, and perhaps also fluid, especially alcoholic, is taken during the long walk, part of its good effect is lost. One of the visible effects of such a walk, combined with a very restricted taking in, is that the body loses mostly between two and seven pounds during the walk. The amount of loss varies according to the condition of the walker, the duration of the walk, and other circumstances; as a rule, not without exceptions, large persons lose more than small ones; fat persons more than lean; those who are

unaccustomed to long walks lose more than those who habitually take them ; those who drink much before starting more than those who have taken only a small amount of fluid. A fast walk combined with some climbing leads to a greater loss than a walk at a slow pace and on level ground. The amount of, or the absence of, sunshine, the temperature, the relative humidity of the air, the presence or absence of wind, and other agencies, exercise considerable influence on the amount of the loss of weight. This loss consists almost entirely of water through the skin, the lungs and the kidneys, but with the water some salts and excretory substances are removed. By the simultaneously increased removal of fluid and diminished supply of solid food and of fluids more used-up material is withdrawn, and the somewhat thirsty blood and starved tissues are enabled to take up more new material. The weight lost on the long walk is usually regained within two or three days. The *increased removal of waste products* is one of the most beneficial influences of such a long walk.

Many persons, including some medical men, are of opinion that it is injurious to take much active exercise, especially in advancing years,

that the body is sooner worn out by it than by rest or very restricted exertion. A friend of mine, who was known by many of you, the late Mr. George Pollock, often told me this, and tried to dissuade me from my long walks, as he believed that they would "wear me out." He did not succeed in dissuading me, as I am sure that this "*wearing out*" theory of the organs by making them work is wrong. The animal body is not a machine made of dead substance, like wood or leather or stone, but is made of living organs and tissues which by action are not worn out, but nourished and maintained in working order, provided always that the exercise is not over-exercise. Many more people wear out too soon from *over-rest* than from *over-exercise;* and this is true, not only with regard to the muscular, but also with regard to the circulatory system and the brain. In muscular work we have not to deal with a fixed sum of force, which, when spent, cannot be replaced, but the wear and tear of the muscle is more than compensated by increased supply and increased power to assimilate this supply and to remove the waste material. Dr. Martin Luther's motto, "*Rast ich, so rost ich*" (If I rest, I rust), holds good

for the body as well as the mind. Old persons accustomed to much exercise may go on taking it *as long and as much as agrees with them, and need not think of the number of their years ;* but they must, on the one side, avoid fatigue and on the other keep up the habit, if they wish to keep up their power, for if they leave off taking good walks for some weeks or months, it frequently happens that they cannot resume them without injuring themselves, unless they do so judiciously and gradually. In this respect there is a great difference between the old and the young. Young people who have been prevented taking active exercise by one cause or another can easily resume it and gradually increase the amount ; but in old persons the muscular fibre, the involuntary as well as the voluntary, has a great tendency to waste, unless it is kept in action, since the small nutritive vessels and the small lymphatics become atrophied by want of action.

Another advantage of several hours' exercise in the country is the exposure to the open air, which is scarcely to be overrated ; it improves the oxygenation of the blood ; it cheers the mind ; it strengthens the skin and the nervous system, and through this the digestive system and the whole organism ; it increases the

resisting power to meteorological influences, and diminishes the liability to chills and other microbic affections ; and this *resisting power* is one of the great factors of longevity. Life in the open air, by itself, even without exercise, increases the resisting power, and ought therefore to be arranged for delicate persons who are unable to take active exercise ; it may be done by driving in open carriages or in bath chairs, by lying in hammocks, or by sitting and lying in open verandahs, or in *open shelters*, such as now fortunately are being multiplied at most of the seaside resorts, and ought also to be abundantly supplied at all inland health resorts, in squares and parks, and in private gardens. It is not for tuberculosis alone that open-air treatment is useful, preventive as well as curative, but also for almost all other chronic deviations of health and tendencies to disease, such as affections of the blood and of the nervous system, mental depression, and sleeplessness.

People to whom the so-called "walking without an object" is tedious must endeavour to find an object ; I have often, for instance, succeeded in inducing people to take regular walks, by suggesting to them to keep dogs, and, in consequence, they walked for the sake of their

dogs. When the dog scheme is impracticable, I have not rarely succeeded by awakening an interest in trees, in flowers, in botany in general, in zoology or in mineralogy and geology, and all objects of Nature, and occasionally also by explaining the ways by which open-air exercise and open-air life influence the health of the body. When persons understand this, their knowledge stimulates their will; the will overcomes the dislike; and gradually the feeling of improved health leads to actual enjoyment of that which had formerly been tedious to them.

Walking or Climbing Tours.—Still more beneficial than the once a week extra exercise is the plan of taking in addition, once or twice a year, a *walking or climbing tour of three to four weeks or more* [136] in mountainous districts, especially in the neighbourhood of and on glaciers, with three to six or eight hours' active walking or climbing on most days of the week, provided that the organs of the body are free from disease, and that they be gradually accustomed to the increased work. The amount of benefit to be obtained from such tours, if judiciously arranged, can scarcely be exaggerated. They exercise an actually rejuvenescing influence in which every organ of the body shares more or less, from the

brain to the skin and hair. The power for mental work is increased, the view of life's duties and worries and hardships is corrected, the sleep becomes sounder; and often I have observed that the hair of the head and beard, when commencing to turn grey, has resumed, after good courses of climbing, more or less of the original colour. The action of the heart is likewise in all persons tangibly improved, in some to an astonishing degree. Again and again I have witnessed in many others and in myself, that while before the climbing tour a slight exertion in walking caused the pulse to rise from 60 or 65 to 110 and 130 and more, the same or even a much greater exertion produced, after the climbing tour, only a rise to 80 or 85. The pulse tracings by the sphygmograph are equally significant. Inseparable from the strengthening of the heart is that of the blood-vessels, especially the arterioles, the capillaries and lymph vessels on which depends the improvement of the nutrition of all the tissues and organs of the body. The removal of waste products to which I have already alluded, as an important effect of all forms of exercise, is most thoroughly accomplished by these walking and climbing tours. Dr. Austin,

in his interesting paper, "On Mountain Climbing for Professional Men," justly remarks that climbing tours exercise a powerful influence on strengthening the will, the importance of which I shall discuss later on. I must, however, lay stress on the condition already mentioned, that the different organs of the body must be sound if such courses of extra exercise are to be practised. I have repeatedly seen great harm follow them in persons affected with diseases of the heart, the small blood-vessels, the lungs, the liver, kidneys and spleen, in various forms of diabetes, albuminuria, and anæmia. For these, too, open air and exercises are very beneficial, but their use must be carefully arranged according to the individual condition; over-exertion is to be strictly forbidden.

Respiratory Exercises.—When reasoning about the causes of this remarkable improvement in the heart's nutrition and action, and in the condition of the blood-vessels effected by climbing tours, I came to the conclusion that it was caused to a great degree by the deep inspirations which are necessitated by the act of climbing, especially steady and prolonged climbing. This consideration has led me to pay particular attention to *respiratory exercises*, which since

then have been very useful to myself and many others, especially persons with weak heart muscles. I make no claim of originality for these movements. Although I have come to them more than thirty (now forty) years ago by my own observations on others as well as myself, I gladly acknowledge that I have been forestalled in their publication by others, and especially by Dr. Harry Campbell's excellent work on "Respiratory Exercises in the Treatment of Disease" [22]. From various communications by Mr. S. M. Mitra I have further learned that a "breathing cure" has been practised in India for thousands of years, called by the Indians "Pranayam," which means the "regulation of vital energy" [84]. As in walking and other bodily exercises, the amount and modus of respiratory movements must be adapted to the individual condition. It is often injurious in cases of great weakness of the heart or lungs, or the sequelæ of recent pneumonia or pleurisy, or after recent hæmoptysis, or other acute disease, especially rheumatic fever and influenza, to begin at once with forced respiratory movements. I have mostly commenced, even in healthy persons, with moderately deep inspirations and expirations continued

during two to five minutes, once or twice a day, and have gradually increased the exercises to ten minutes or a quarter of an hour once or twice a day. The depth of each inspiration and expiration, and the duration of holding the breath, are likewise to be only gradually increased. At the beginning an eighth, a sixth, or a quarter of a minute for every inspiration and every expiration ought to be sufficient; if this is well borne, each act may be gradually prolonged in duration, so that in the majority of cases each inspiration and each expiration may be brought up to a minute and more, although half a minute is quite enough for each act. I usually advise to inspire in the erect position with raised arms and closed mouth, and to bend down the body during expiration so that the fingers touch the ground or the toes. The expiration may be made with closed or open mouth, but for the inspiration the breathing through the nose with the mouth shut has the advantages of warming the air and removing palpable impurities by the passage through the nasal cavities, and inhaling through the mouth ought to be avoided. During the exhalation the abdominal muscles ought to be thoroughly contracted in order to compress the contents of the stomach. By degrees one

can learn to make several up and down movements and various exercises of the arms, such as bending and stretching, or moving them about in a circle during every inspiration, and bend and raise the body several times during each expiration. By this alternate bending and raising of the body we gain the additional advantage of strengthening the lumbar muscles, and through this successfully combating the tendency to lumbago. Another useful combination with the respiratory exercises is the turning of the body in the erect position round the axis of the spinal column alternately, with deep inspiration from left to right, and with expiration from right to left, with the arms raised to the horizontal position. By this movement we bring into action, in addition to the lumbar muscles, some of the other muscles of the spine which are apt to be only imperfectly used by most persons, especially in advanced years ; and we also prevent, to some degree, the stiffness of the neck and spine and the tendency to stoop, so common in old people. Another combination of breathing exercises with exercises of the limbs is effected by placing the foot on a chair or other raised surface, and alternately exhaling and inhaling with thorough bending

of the joints of foot, knee and hip, and contracting the abdominal muscles during expiration. A further mode is the forcible extension of the leg with full expiration and bending up with inspiration. Yet another combination is the swinging of the legs over a bar or a chair with alternate inspirations and expirations. Further combinations with muscle and joint movements will occur to those who have accustomed themselves to these respiratory movements; but the latter ought always to have our principal attention, since to them the beneficial effect on the heart and lungs is mainly due. In addition to the influence on the nutrition of the heart and blood-vessels, the respiratory movements keep up the nutrition and efficiency of the lungs themselves, which are apt to undergo in old age a kind of atrophy. The *senile emphysema* which frequently occurs in old people is thus prevented. By improving the nutrition of the lungs we also counteract the tendency to chronic bronchial catarrh and to pneumonia which form frequent causes of death in old age. Another important influence consists in maintaining the *elasticity* of the *chest walls*, and the articulations of the ribs, which are apt to become ossified in old age, and thus

to interfere with the free movements of the lungs and the pleura. In connection with the chest walls we may direct attention to the *ribs* on which the deep respiratory movements exercise a kind of massage. The nutrition of the ribs is, through this, kept in a satisfactory condition, bone as well as marrow, and we regard this as a matter of importance, as the *marrow* of the ribs assists the formation of the red blood globules. In addition this improved nutrition renders the ribs less liable to fracture so frequent in old age. If for some reason the erect position should be inconvenient, the mere respiratory movements can be made also in the horizontal and sitting positions. I have already alluded to the additional advantage of the compression of the abdomen, which is effected by the contraction of the abdominal muscles during deep expirations, and which ought always to be practised thoroughly; by this all the organs contained in the abdominal cavity are compressed, especially the stomach and intestines, and the blood is squeezed out of the veins. All the organs of circulation—heart, arteries, veins and lymphatics—are powerfully influenced by these deep respiratory movements.

They are especially useful to literary workers,

statesmen, professional men and others who are unable or disinclined to take one of the usual modes of exercise. The most convenient times for practising them are in the morning before or after the bath, when the body is loosely covered with flannel, and in the evening when dressing for dinner, or before going to bed. I must, however, repeat that the *energetic* breathing exercises are not suitable for very delicate persons ; they are, for instance, injurious in great dilatation of the heart, with or without valvular disease ; such affections require much *milder* movements, like those practised at Nauheim ; nor are the more energetic breathing movements suitable in *active* tuberculosis, and in the early stage of convalescence from severe acute diseases. In more quiescent forms of tuberculosis, or in arrested tuberculosis, however, and in the imperfect expansion of the lungs, resulting from pleuritic effusion, they can be rendered beneficial by practising them judiciously.

I need scarcely say that by the improvement which walking and climbing tours and respiratory exercises effect in the nutrition of the tissues they increase the resistance to disease, one of the most important factors in the prolongation of life.

Breathing exercises, and also other gymnastic exercises of a milder kind, are as necessary for women as for men, and even more so for those who take little active exercise. They ought to be practised by them without stays, which impede the free movement of the organs of the chest and abdomen.

We must, however, not restrict our lung-gymnastics to these few minutes of regular respiratory exercises ; but we must create the habit of always breathing not superficially but thoroughly, and taking at several other times of each day deep inspirations, and expirations, especially while walking. At first we are apt to forget this, but by often reminding ourselves of it, it is not difficult to create this *habit of deep breathing*, the advantages of which are very great, in improving the condition of the blood, in strengthening different organs, as explained, and in maintaining the resisting power of the organism, and thus preventing disease.

Other Forms of Exercise.—These respiratory exercises, combined with movements of the limbs and trunk, are different from P. H. Ling's so-called " Swedish gymnastics," but the latter are likewise most useful for the maintenance or health, and they can be adapted with numerous

modifications, according to individual conditions, to many persons who are unable or disinclined to take ordinary walking or riding exercises. *Zander's* mechanical gymnastics, as practised in London, with valuable additions by Dr. Hamel, can be most efficiently employed in exercising the different muscles and joints of the body. The so-called Danish exercises, and Schreber's gymnastics (Schreber's Zimmergymnastik), too, have many similar advantages, and also ordinary gymnastics as they are practised, especially in Germany, under the name of "Turnen," although the latter, excellent as they are for the maintenance of health and the muscular development of the healthy, are rather less suitable to old age than to the earlier periods of life, unless they are specially adapted to the more or less altered conditions of the aged body. The same may be said of military training, which forms one of the most beneficial means of development of nations, physical and mental. The Hindus have, in addition to their breathing exercises, various other forms of exercise for rendering the body supple. These exercises, which they call "Ashan," are very effective. All these exercises not only increase and maintain the muscular force, but strengthen the

whole organism, and its *resisting power* against disease.

One of the most useful exercises is *swimming*, which not only powerfully influences the whole metabolism, but also specially strengthens the skin and the whole muscular system; it ought, however, to be avoided by the majority of aged persons, unless the organs of circulation and the kidneys are still sound. It will occur to everybody that much depends on the temperature and on the degree of motion or the water. If the water is warm, the organs of circulation and the kidneys are much less taxed than by swimming in cold water, and if the water is agitated, as is more or less the case in the open sea, the tax is very much increased. The most agreeable temperature for a swimming bath is between 72° F. and 80° F. Swimming ought to be taught in all schools for girls as well as boys.

Cycling has been strongly recommended by some men as a good form of exercise, preferable in many cases to walking; but the great majority derive much more benefit from the latter. In some instances, however, where the dislike to walking is very great, or where there is some defect in the feet or legs by which walking is

rendered difficult, cycling is often a good substitute. I have, however, seen a number of men, as well as women and children, who have become ill from over-exertion in cycling. We can understand this, if we consider that the feeling of fatigue in cycling is perceived less than in walking, and that therefore the danger of overstraining is greater in the former than in the latter form of exercise. Great harm I have seen in diseases of the kidneys, and I can endorse Senator's condemnation of cycling in all such cases, even when the health otherwise appears perfect.

A disadvantage of cycling compared with walking is that the cyclist is more or less restricted to the carriage road, which does not always give the finest views, and that he cannot enter into all the hidden nooks replete with their botanical, zoological, and geological treasures.

A most useful form of exercise, which involves a more or less prolonged and regular stay in the open air, occupying mind and body at the same time, is *Golf*. Another kind of exercise requiring still more mental attention, more, in fact, than any other gymnastic exercise or sport, is *Fencing*. Every movement of the opponent requires to be constantly watched and acted

upon instantaneously. At the same time it promotes the greatest precision and a certain degree of neatness of movement, and brings into action almost all the muscles of the body with the least expenditure of force. Amongst the indoor exercises, playing *Billiards* has advantages to mind and body, especially to those who cannot or will not take active outdoor exercise ; but the billiard-room ought to be better ventilated than it often is.

Angling is another pursuit to which many of my friends have ascribed their health and happiness and long life. Izaak Walton himself, "the father of angling," lived to be 90. Long hours in the open air, with constant moderate exercise, enjoyment of nature, and meditative contentment of mind, go far to explain this.

Gardening is likewise a source of health and long life to many persons, not only rich but also comparatively poor, especially females who object to or are prevented from taking long walks. It occupies the mind in an agreeable manner, and ensures a certain amount of exercise in the open air without over-fatigue.

Another convenient form of exercise, especially useful in gouty people, recommended by Dr. Oliver, is what he calls the *static or tension*

exercises, which consist in the static contraction of all the muscles of the body, while standing, for one or two minutes several times a day. In goutiness the arterial pressure is increased and the tissue fluid is prevented from returning to the blood and lodges in the tissue vacuoles. Tension of the muscles diminishes the arterial pressure, and allows the tissue fluid to be absorbed. Dr. Oliver finds that one minute's tension clears up as much as 20 per cent. of lymph. These tension exercises may be practised best an hour before all meals, when Nature itself produces a normal fall in the arterial pressure ; but other times may be substituted, if more convenient.

While recommending walking and climbing tours, and respiratory exercises, and various forms of gymnastics, I must guard myself against the indictment that I disregard the value of riding on horseback, rowing, skating, cricket, football, tennis, hunting, shooting, and many other kinds of sport. I, on the contrary, regard them as most useful to a very large number of persons, promoting strength of will, courage, and presence of mind ; but I am unable to enter upon them in this short discourse. To all, *if properly exercised*, and excess be avoided,

may be applied the Arab saying, "The days spent on the chase are not counted in life's course." We might even say that they add to the sum of life.

If active exercise is impossible by certain conditions of the body, *massage* may be substituted temporarily, and driving in open carriages and bath-chairs.

VII.—Digestive Organs and Food.

Attention to the *digestive system* and *food* is as necessary for the promotion of longevity as that to the circulatory and respiratory systems, which are intimately connected with them.

The aim of dietetics or rational arrangement of taking food is, as E. von Leyden says [71]: (1) to maintain health and promote long life; (2) to prevent disease, and increase the resisting power against disease.

Acting on the suggestion of some readers of the former editions of this lecture, I insert a short account of the principal articles of food, but must refer to more complete treatises such as Koenig's [68], Rubner's [112], von Noorden's [92], R. Hutchison's [62], H. Snyder's [121], Chalmer Watson's [132].

We usually understand by *food* organic substances suitable for the maintenance or the increase

of the body, and serving as sources of energy necessary for the execution of work and the formation of body heat (von Noorden). The ordinary constituents of food consist of proteins, carbohydrates, fats, different kinds of organic and inorganic salts and water; there are, besides, in the food substances other constituents such as extractives, condiments, ethereal oils, which are not regarded as necessary for the body, and the functions of which are not quite clear, but which may act as stimulators of various groups of cells, and may thus influence the metabolism (von Noorden). The proteins, the mineral constituents and water are chiefly concerned in building up and in replacing waste in the cells, while the carbohydrates (glycoses, saccharoses, amyloses, pectoses) and fats are the chief energy-yielding substances, in which function they are, however, greatly assisted by the proteins (R. Hutchison). The mineral substances, especially phosphorus and calcium and sulphur, play a much greater *rôle* in the nutrition of the cells and the metabolism of the body than is usually assumed.

The nutritive value of different kinds of food depends (1) on the amount of proteins, carbohydrates, fat and salts they contain, and (2) on the amount of these matters digested in the stomach and intestines and absorbed into the blood. As this amount is not the same in different persons, in other words, as the digestive and absorbent powers vary, the same articles of food need not have the same nutritive value to different individuals. Our knowledge of the action of different kinds of food on the organism is as yet imperfect. From experiments on animals for instance we learn that certain diets

greatly lower the resistance of animals to certain poisons, but this important point is, as yet, not sufficiently elucidated, and what we know, we can, as yet, apply to man only in a very limited way.

We derive our food partly from the animal, partly from the vegetable kingdom. The principal articles of animal food are the different kinds of meat and other flesh foods, eggs, milk and casein preparations. Under *flesh food* we may include beef, mutton, lamb, veal, pork, poultry, venison, game, the different kinds of fish, lobsters, crabs, oysters, snails, &c. ; under *vegetable food*, the different kinds of grain : wheat, rye, oats, barley, rice, maize, buck-wheat, millet, &c. ; almonds, nuts, haricot beans, peas, lentils, the green vegetables, tubers, fruit and mushrooms.

The various kinds of *flesh food* are characterized by a large proportion of proteins ; they contain, roughly speaking, about 25 per cent. of solids and 75 per cent. of water ; the solids consist of about 75 per cent. of albumin and 25 per cent. of gelatinous matter, extractive matters, fat and mineral substances. All kinds of flesh food contain a certain proportion of so-called purin bodies, compound substances from which uric acid is formed. The composition of the different kinds of flesh food and their action on the body are not quite the same, but the idea entertained by many persons that so-called *butcher's meat* is much more liable to cause morbid changes in the metabolism, leading to diseases of the blood-vessels, gout, excess of uric acid, &c., than the so-called white meats and fish, and that these may be taken in much larger quantities with impunity, is not proved (von Noorden) ;

and G. Oliver found the blood-pressure, after the ingestion of white meats, very similar to that after butcher's meats. I lay some stress on this point, because I have often found that patients suffering from gout, renal troubles, uric acid, stone, eczema, hæmorrhoids, &c., thought they might eat large quantities of poultry, game, venison and fish, if they only avoided beef and mutton, and that this erroneous view caused aggravation of their troubles.

Although the different kinds of flesh food exercise a more or less similar influence on the metabolism of the body, it does not follow that it is to all persons the same, whether they eat half a pound of beef, or of mutton, or veal, or pork, or chicken, or fish. There are in this respect great differences in different persons, and even in the same person according to the state of health. There is, further, a wide difference in the digestibility of meat according to the age of the animal, or the state of its nutrition and the way in which the animal had been fed or killed, or the part of the body from which it is taken, or the way of preparing and cooking. The flesh for instance of very young and very old animals is less digestible than that of grown up but not old animals. As an instance of the difference which exists between different parts of the same animal, we may compare bacon with ham. An average piece of bacon contains twice as much fat as an average piece of ham of the same weight and less than half the quantity of protein and only very little purin. *Pork* may serve also as an example to show the influence of preparing food, independently of the action of other ways of cooking; fresh pork is to many persons indigestible,

while well-cured pork, such as ham or bacon, is easily digested by them; *cold boiled bacon* is in fact to most people an excellent article of food, not so fried bacon; and this shows that the digestibility of the same article of food varies greatly according to the manner of cooking.

Mutton may be regarded as rather more easy of digestion than beef; but the fat of mutton is intolerable to some persons. Boiled neck of mutton is most easily digested.

Lamb, as a rule, is less nourishing and somewhat less digestible.

Veal is very different in different countries; it is rarely tender in England, while on the Continent, especially in Austria and the Tyrol, it is generally tender and easy of digestion, as for instance "Wiener Schnitzel." Amongst the different kinds of *Game*, young partridges, pheasants and grouse are easily digestible, and the same may be said of hare and rabbit when young and tender. The breasts of young chicken and turkey are easily digestible, while the legs are less so. Geese and ducks are inferior to chicken in digestibility.

Allowing for such differences, we may roughly say that tender and well-prepared meat belongs to the easily digestible and most nourishing articles of food. It does not, however, contain all the substances which are necessary for the maintenance of health, and must be supplemented by the addition of others such as carbohydrates.

Different kinds of *fish* are differently borne by the same person and by different persons. Whiting, sole, brill, smelts, pike, haddock, cod, and the more lean kind of fish are, to the majority of people, more

digestible than the richer kinds, such as eel, salmon, mackerel, sardines, and herring. We may designate the former, if carefully cooked, easily digestible, but not more so than well-selected and well-cooked meat. Fish cannot be regarded as an entire food, still less so than meat.

Oysters, when taken raw, are easily digestible to most persons, but not so when boiled. They consist principally of water, with some protein, fat, and carbohydrates. Their food value is small compared with eggs and meat of the same weight. The possibility of contamination with the typhoid bacillus is always to be kept in mind.

The flesh of *lobster* and *crab* is dense and not suitable for delicate digestive organs, while to some persons, of whom the late Emperor William I of Germany is an instance, it is an easily digestible article of food.

Eggs are to the majority of people easily digestible, but some persons cannot bear them and on a few they even act as a poison by causing heartburn, diarrhœa, vomiting. They are very nourishing. Hirschfeld calculated that a hen's egg of medium size is equal to nearly 2 ounces of lean meat, and to nearly 9 ounces of good milk. They are more easily digested in the raw, or only slightly boiled, condition. The white of hard boiled eggs requires thorough mastication, else it remains long in the intestines and may lead to decomposition with the development of sulphuretted hydrogen and other intestinal disturbance. The yolk is more nourishing than the white, it contains less water, more proteins, fat, and mineral matter, including iron and phosphorus organic compounds; the white

is free from fat. The latter raw, or only slightly boiled, is by many persons more easily digested than the yolk. The late Sir J. Y. Simpson, of Edinburgh, the celebrated gynæcologist, was in the habit of restricting some delicate patients for many weeks and months almost entirely to the raw white of eggs, well beaten up and seasoned with a little salt, and did so with great benefit to their health, a fact which I have been able to corroborate. Eggs have, to persons suffering from the uric acid diathesis, the advantage of being almost free from purin bodies.

Eggs are easily absorbed in the alimentary canal, and only a small proportion passes off with the fæces ; hence they are apt to cause constipation, from insufficiently stimulating the intestines, and ought to be combined with other articles of food correcting this effect, such as brown bread, green vegetables and fruit. They ought to be new-laid, not stale.

Milk is one of the most useful articles of food, I may even say the most perfect food, as it contains all the substances required for the building up and the maintenance of the body, including the mineral substances. The sale of milk ought, therefore, to be under the strictest supervision of the authorities, including the farm and its inhabitants, the milking, the cows, the milk cans, the transmission from the farm to the dairy in town, and the supply of the public by the dairy. The "Milk and Dairies Bill," introduced in 1909, constitutes in several points a great progress. In addition to all this, however, the greatest care should be taken in the house of the consumer to avoid

contamination of the milk by exposure to impure air, or cats, or rats, or mice, or flies, or by the use of unclean vessels. Milk ought to be kept in a well-closed vessel and in a cool place. Metchnikoff directs attention to the very important point that milk gives rise in the stomach and intestines to the development of the *milk bacillus*, a friendly bacillus which combats the hostile bacilli found in the intestinal tract, and thus counteracts putrefaction with its injurious consequences (auto-intoxication). This bacillus is also developed outside the stomach when the milk is allowed to stand and become sour. *Sour milk* is often declared as injurious, but this is by no means the case with regard to the majority of people, who in fact bear it well. To Sir Thomas E. Fuller, the former Agent-General for Cape Colony, I owe the information that a kind of sour milk forms an essential article of food amongst Kaffirs, and that many Europeans, affected with various chronic illnesses, have lived on it almost entirely for long periods, residing with the Kaffirs, and have ascribed their recovery to its use. Professor Metchnikoff found, when travelling in Bulgaria, that the people living there preserve their youth longer, and that a much larger proportion attain a long life than is the case in Western Europe; he ascribes this to the regular use of soured milk which is now prepared, according to Metchnikoff's prescription, in Paris, London, and other places. The *lactic acid* contained in the soured milk is a powerful agent against putrefaction and thus counteracts the tendency to auto-intoxication. The addition of preservatives to the milk, to prevent its becoming

sour, which has of late become general, is not always judicious, and ought to be allowed only exceptionally and with great discretion. The question of taking milk boiled or unboiled must be answered principally according to the quality of the milk; if the milk is obtained from healthy cows, and is otherwise pure, it is to most, though not all, persons more digestible, and also more nourishing, in the unboiled than in the boiled state, but if the purity is uncertain it is prudent to boil it. The actual boiling ought, however, to be restricted to a few minutes, or even less. For most purposes it is enough to raise the temperature of the milk to about 60° to 70° C. (about 140° to 158° F.), and keep it at that temperature for about a quarter of an hour or a little longer. Strongly boiled milk may cause in some infants fed on it a kind of scurvy (Sir Thomas Barlow). *Cream* contains less water and casein and more fat than milk; if it is obtained by the centrifugal process, it contains more fat than the cream obtained by skimming. *Cream* is an agreeable means for fattening, but some persons must dilute it with water or lime water. *Devonshire* or *clotted cream* contains about double the amount of fat as ordinary cream and less sugar. *Whey* prepared with rennet contains the greater part of the milk sugar, and the mineral salts of the milk and a small quantity of lacto albumin; it is slightly nourishing and diuretic. *Buttermilk* is easily digestible; it is less nourishing than ordinary milk, as it has lost almost all the casein and a large portion of fat, but it is still a valuable article of food and is not sufficiently appreciated; it is also more diuretic than the whole milk. *Skim milk*

contains more casein and less fat than ordinary milk, and is a cheap and good article of food when supplemented with carbohydrates, such as potato, maize, rice, and bread; it agrees better with most persons suffering from disease of the kidneys than unskimmed milk or cream. Although milk contains all the substances required for nutrition, it is inconvenient for healthy adults to live entirely on milk for a long time, as the bulk required would be very large. If milk in its natural state causes indigestion this can often be avoided by the addition of lime water (1 part to 4 to 6 of milk) or of citrate or bicarbonate of soda or potash, or of barley water or gruel. *Koumiss* is a fermented milk made originally in the Russian steppes from mare's milk, but now made also in Europe from cow's milk. It contains lactic acid and a small quantity of alcohol, varying according to the state of fermentation. It is an agreeably effervescing drink and more easily digestible than ordinary milk to most people. *Kephir* is similar to koumiss.

Butter, well prepared and fresh, is to the majority the most easily digestible, and at the same time the most palatable of the fatty substances used as food. The amount of real fat in butter varies; the average may be regarded as between 75 and 82 per cent., the remainder consists of water and a small quantity of casein and milk sugar. When I designate butter as easily digestible, I mean fresh butter in the raw state, for after having been cooked, especially after having undergone frying, it deranges the digestion of many persons by the development of butyric and other fatty acids, in which it is very rich. In this

respect *margarine* has an advantage over butter, as it contains scarcely any fatty acids, and in consequence of this and of the absence of casein, keeps much longer and becomes not so easily rancid. Although it has not the nice flavour of the finest kind of butter, it is a very good article of food, especially for cooking, and is much cheaper. The prejudice against margarine was unfounded, and it has justly found its way into the kitchen also of rich people. The most important function of the different kinds of fat and the carbohydrates in the animal economy is the creation of heat and energy, and in this respect it may be said that the same weight of fat produces twice the amount of heat than either carbohydrates or proteins.

Cheese, another derivative of milk, varies considerably according to the way of making it. The odour and flavour of the various kinds of cheese are due principally to the kinds of ferment used and to differences in the bacterial action, and to the degree and stage of decomposition produced by them (ripening). There are hard and soft varieties according to the degree of pressure exercised in removing the whey from the casein. If the greater part of the fat is removed from the milk and a *lean* cheese is produced (such as most of the Dutch cheeses, single Gloucester and Parmesan are), it agrees much better with persons of weak digestive powers, by being less apt to develop butyric and other fatty acids in the stomach. If all the cream is left a fatter cheese is produced, such as Stilton, Cheddar, double Gloucester, Cheshire, Gorgonzola and Gruyère, and still more so if cream is added. Cheese is very nutritious, 1 lb. of cheese being equal

to about 2 to 3 lb. of beef, but it requires careful mastication. The fatter kinds of cheese are richer in proteins and fat combined than any other article of food. The softer varieties of cheese, like Brie, Camembert, Limburg, disagree rather frequently, partly because they are often swallowed without mastication, partly from being taken when already too much decomposed, but if they are taken fairly fresh in moderate quantity, and are well masticated, together with bread they are to most healthy people easily digestible. A moderate quantity of cheese, taken not as a luxury but as a meal with bread, or milk, or potatoes, is well borne by the majority of persons, and is one of the cheapest and most nutritious articles of food. To many persons, especially of a gouty constitution, the substitution of a certain amount of cheese for flesh food is a wise proceeding, but, if taken at the end of a full meal, it often disagrees, and cannot be recommended, since the powers of the digestive organs are already taxed to their limits.

Dried casein is an easily digested article of food, and can be used in soups, with macaroni and other dishes; it is the principal constituent of *plasmon*, *sanatogen*, *nutrose*, *casumen*, *eucasin*, and other nourishing preparations, combined with small quantities of alkalies, especially soda and ammonia. One of their merits is, that they contain phosphorus in an organic combination with albumin which is readily absorbed and enters into the nutrition and metabolism of the cells of the body, as shown by the experiments of Beddoes and others with sanatogen (casein-sodium glycerophosphate).

Greater than in the animal is the difference in

the various kinds of *vegetable foods*, as well with regard to their chemical composition and nutritive value as with regard to other influences on the organism. On the whole, they are less rich in proteins, but are the principal furnishers of carbohydrates, prominently in the shape of starch, dextrin and sugar. The majority of the vegetable foods, excepting the nuts, almonds, and oil-bearing substances, contain less fat than the animal foods. Another characteristic constituent of vegetables is the cellulose by which most of the carbohydrates are surrounded, and which necessitates the dissolving power of cooking and the digestive processes to effect the transformation of the carbohydrates into absorbable substances. Many of the vegetable foods, especially fruit and green vegetables, are further characterized by various vegetable acids, and amongst the saline constituents by a larger proportion of potash salts, which are of importance in the metabolism of the body. Among the characteristics of vegetable foods, it may be mentioned, that the proteins contained in them are less prone to putrefaction in the intestinal canal, than those of flesh foods, which constitutes a point in favour of vegetable foods.

The most important group of the different vegetable foods is formed by the *cereals*, the principal representatives of which are wheat, rye, oats and barley. They contain proteins and carbohydrates, some fat, cellulose and mineral matters, including phosphorus and iron, in fact, all the constituents of the human body. Wheat and rye are of the greatest interest to us, as bread, one of our staple articles of food, is prepared from them. In England, almost

only wheat flour is used, while in Germany, Denmark, Sweden, &c., rye bread (black or grey bread) was in former years eaten by the greater portion of the population, wheat bread (white bread) only by the richer classes; gradually, however, the use of white bread, or of bread made from a mixture of rye and wheat flour, has, there too, become more general. Rye bread contains a much larger amount of cellulose, and, owing to this, a larger proportion passes through the bowels, unabsorbed, than of fine white bread; it is, therefore, weight to weight, regarded as less nourishing than white bread. On the other hand, rye bread does not become dry so quickly as white bread, and keeps longer fresh, which is an advantage, especially in some rural districts, where bread is, or used to be, baked only once or twice a week. We must also take into consideration that the flour of rye contains more organic phosphorus compounds than fine white wheat flour, a fact which is of great importance to the nutrition of the body. It is not correct to calculate the nutritive value of bread merely by the proportion of proteins and starch.

There are a great many kinds of bread, differing according to the quality of the corn, the fineness of the flour, the manner of preparation, and the removal of parts of the corn or the addition of other substances. We cannot enter into a description of the different processes of baking or the numerous kinds of bread, but must say a few words about so-called *brown bread* as compared with white bread. Professor Graham, the celebrated chemist, afterwards the Master of the Mint, was the first

who, in a scientific way, brought the advantages of using, in the preparation of bread, all the constituents of the wheat—the bran, as well as the fine flour of the centre—before the public. As Liebig devoted a special article, in his celebrated "chemical letters," to Graham's plan, the term "Graham Bread" was adopted on the Continent. Since Graham's and Liebig's time it has been found that the removal of the outer layers of the grains of wheat, rice and barley may cause polyneuritis, beri-beri, and a kind of scurvy in those who live entirely or principally on the finest part of the flour or on polished rice. Feeding experiments on animals have corroborated this experience (Leonard Hill and Martin Flack). The loss of the greater part of the mineral matter must be regarded as the cause of these troubles, since the addition of bran to the food removes them. Not all kinds of brown bread, however, are the same. The majority of bakers mix a varying amount of bran with white flour, not always in a fixed proportion, while Graham wanted the bread to be prepared from all the constituents of the whole corn—"wholemeal bread" or "wheaten bread." The corn may be so thoroughly ground that the flour is comparatively fine to suit certain delicate conditions of the intestines, or only roughly ground, making a coarser bread more useful to many persons troubled with habitual constipation.

The late Sir Henry Thompson has given a good prescription from which some bakers (Spiking and Stewart) make a very palatable bread (Thompson's wholemeal bread). This kind of bread is nutritious, easily digestible to most people, and

helpful in assisting the action of the bowels. Some persons, with an irritable mucous membrane, or with a suspicion of ulceration in the stomach or intestines, ought to use a bread prepared from a finely ground corn, which, however, ought to contain the germ and part of the bran. A larger proportion of brown bread passes off with the fæcal matter than of white bread, owing to the great amount of cellulose contained in the bran; a slightly smaller proportion of brown bread is absorbed than of fine white bread, and brown bread is therefore considered by many persons as less nourishing. This view, however, must be taken with reservation. There are, no doubt, as the experiments alluded to show, substances in the outer part of the grain which are necessary to the body, though we do not yet know their exact nature, and those are absent in the finest white bread. In the mixed diet of most persons bread forms only a part of the food, and the substances referred to may be contained in the other parts of the food. Considering the advantages and disadvantages of white and brown breads, the advantages of the latter (Graham's and Thompson's bread) predominate for the majority of people; this, at all events, is the result of my experience after long continued observation on a great number of persons.

Bread, although an excellent article of food, is not quite as perfect as milk, but combined with the latter, it is sufficient for the nutrition of the human body. It is easy of digestion, if properly baked, if not taken too fresh, and if thoroughly masticated. Biscuits, rusks, and toast are still more so, since owing to their dryness more perfect mastication

is necessitated, and through this the secretion of an increased amount of saliva, so important in the digestion of farinaceous food, is effected.

Toast is to many persons preferable to ordinary bread. The latter often contains ferments, which are destroyed by the heat employed in the process of toasting.

There are several other preparations of wheat in use which are easily digestible and nutritive. The best known are macaroni, semolina, shredded wheat, florador, granola, and Allenbury's foods.

Oats are very nourishing if well ground or rolled. Owing to the absence of gluten, they cannot be used for making bread; but the different preparations in commerce, such as oatmeal, Quaker Oats, Waverley Oats, groats, &c., yield excellent porridge and similar dishes, which when combined with milk and its derivates, offer all that is required for nutrition. Oatmeal, I may mention, ought to be thoroughly boiled, which is occasionally neglected. For some persons suffering from constipation oatmeal has the advantage of acting gently on the bowels. Oat cake is nutritious and to most persons an easily digestible food.

Barley forms a most useful article of food, for soups, porridge, barley water, though it contains rather less protein than wheat. It is likewise not quite suitable for making bread, as it is poor in gluten; but by the addition of wheat flour it yields a fairly satisfactory bread.

Different from the cereals just mentioned is *maize*, which contains less protein, but more fat and carbohydrates. It cannot be used for bread from its want of gluten, unless mixed with wheat

or rye, but it is easily digestible, and has much nutritive value. The numerous preparations in use, maizena, cornflour, oswego, hominy, &c., form excellent puddings. I have often come in contact, in the Swiss and Italian Alps, with natives of Upper Italy, principally of the district of Bergamo, who for three or four months every year lived entirely on polenta, milk and cheese, performing as shepherds much active work and enjoying perfect health. The addition of milk and cheese supplements the small proportion of protein contained in maize. These shepherds consumed on an average per day and per individual two pounds of maize flour, four to six ounces of cheese, and a pint of milk.

Rice contains still less protein than maize, and very little fat, but it is richer in starch. If well boiled, which is essential, it is easily digested and almost entirely absorbed. Rice alone deprived of the husks (polished rice) is, however, an imperfect food. The experiences of man and the experiments on animals, referred to above, show that disease is produced in animals entirely fed on polished rice, and that this disease is removed by adding the husk or the extract of it to the rice.

Another important class of vegetable seeds, comprised under the term of *pulses*, is represented in our dietary by *lentils*, *peas* and *beans*. There are some differences between them, but they have in common a large amount of a variety of protein named *legumin* or vegetable casein; they have a slightly smaller proportion of carbohydrates than the cereals, and are poor in fat but rich in salts. They are very nourishing, but require a strong digestion. Owing to their containing much sulphur,

they are apt to give rise to flatulency; lentils have this disadvantage in a lesser degree. They ought to be taken only as part of the food, *i.e.*, together with other kinds of food, such as green vegetables, fruit, milk, bacon, &c., and only sparingly by persons of sedentary habits and those of gouty disposition, since they are comparatively rich in purin.

The various kinds of *nuts* and *almonds* require careful mastication in order to render them digestible; they contain a moderate amount of protein and a large proportion of vegetable fats, which by vegetarians are used instead of butter, lard, and other animal fats. Cakes made by some companies from ground nuts, cereals, and fruits are nourishing, and are much liked by persons accustomed to them. They require thorough mastication.

In the south of Europe *chestnuts* form a valuable article of food. They are rich in carbohydrates and possess a fair proportion of proteins. Well cooked, they are easy of digestion to most healthy people, but people with delicate digestion ought to avoid them, especially in the raw, imperfectly cooked state.

Green vegetables are rich in water and in cellulose, but poor in nitrogenous matter, in carbohydrates and fat, and they contain a relatively large quantity of mineral matter, such as potash and lime, and combinations of phosphorus, which render them useful and antiscorbutic. By cooking they lose part of their salts, and take up water, so that some cooked vegetables contain only 1 per cent. of solid matter and 99 per cent. of water. They are not easily digestible for the majority of persons with weak stomachs; but much depends

on the process of cooking and on their being fresh or stale; vegetables fresh from the garden are much more digestible than stale ones. The different forms of cabbage, brussels sprouts, cauliflower, belong to the more nourishing kinds of green vegetable, but cause in many persons flatulency, while the branches of celery, cooked lettuce, endive and vegetable marrow are much less nourishing but well borne by a larger number of persons. Spinach is, to the majority of persons, a very useful vegetable, and similar to it is chicory. Green beans require thorough cooking, and not less so young or green peas; the latter, when they become older and more mealy, partake somewhat of the character of pulses above mentioned. Asparagus is fairly well digested by most people, but ought to be taken in only small quantities by gouty persons, on account of the purin which it contains.

Salads made of some uncooked vegetables and fruit, as from lettuce, endive, cress, tomatoes, &c., are refreshing to most healthy persons, but not suitable to the majority of those with delicate digestion. The greatest care ought to be taken in cleaning them, to remove microbes and the eggs of parasites.

Onions, the favourite vegetable of the inhabitants of southern regions, are apt to cause flatulency in the more northern climates where the habits of people are different, and ought to be avoided by persons with weak digestion or taken only very sparingly.

Vegetables with much oxalic acid, like rhubarb and sorrel, can likewise not be recommended to the majority of persons, partly on account of the oxalic

acid they contain, partly, as in the case of rhubarb, on account of the large quantity of sugar which is generally added to it.

The nourishing value of green vegetables is small compared with meat, cereals and pulses, but they are useful by their vegetable acids and saline constituents, especially potash salts, which help to keep the blood alkaline and render the urine less acid ; they are therefore specially adapted to persons with tendency to gout, stone, and some skin affections. Owing to the large amount of cellulose contained in green vegetables only a small portion is absorbed, while a larger portion passes off with the fæcal matters, giving them bulk, and stimulating the intestines, and thus, to some degree, counteracting constipation. It must, however, be remarked that in persons who endeavour to restrict themselves almost entirely to green vegetables, the bulk required is so large, that it leads to great distension of the stomach and intestines, which can only be avoided by substituting for a portion of green vegetables, cereals and pulses, milk, cheese, eggs, or small quantities of flesh food.

Amongst the *roots* and *tubers* used as food, the most important is the *potato*, owing to its large amount of starch, combined with a small proportion of nitrogenous substance, some salts and extractive matters. Potatoes form a valuable article of food, when combined with other nutrients which contain more nitrogenous matter and fat, such as milk and cheese, and fleshy foods. They are easily digestible when well prepared, thoroughly cooked and mealy, and when they are well masticated.

Boiled or roasted in the skin they retain most of their nourishing material, boiled without the skin they lose a certain amount, especially of their useful saline ingredients. Passed through a fine sieve or potato-masher, or in the form of thick soups they are mostly well borne; but fried in thin chips they are indigestible to many persons, and are deprived of much of their food value. Moderately old potatoes are preferable to new and not quite ripe ones.

Amongst other *roots*, turnips, carrots, beetroots and Jerusalem artichokes, are much used; they are characterized by a large amount of water, carbohydrates, and salts, and a very small proportion of nitrogenous matter. They form for healthy persons a useful admixture to other articles of food, and specially flesh foods and cheese.

Arrowroot and *tapioca*, obtained from roots of plants in the West Indies and South America, consist almost entirely of starch, and are of value in some intestinal derangements, but cannot sustain life for any length of time, without the addition of other food.

In connection with the vegetables rich in carbohydrates we may say a few words about *sugar*, which is the purest carbohydrate food. In moderate quantities—of 1 to 4 oz. a day—it is easily digestible to most healthy persons, though it disagrees with a minority by causing rapid fermentation. Taken together with other food it is better borne than by itself. In tendency to corpulence and diabetes it is to be avoided. Sugar is called by some authors a muscle food, but this term leads to misunderstanding, as it cannot be actually

transformed into muscle, but it produces *energy* and *saves* the muscle during exertion. I have often found this in myself and my guides in severe climbing; when unprovided with tea or coffee, and when our strength began to flag, a few lumps of sugar helped us on wonderfully. Large quantities of sugar, however, when taken together with a full amount of animal or mixed food, prevent thorough metabolism of the proteins, and lead to diseases of metabolism, such as gout, uric acid concretions, diabetes, and indirectly also arterio-sclerosis.

Sugar alone is an insufficient article of food; and this is also the case with other carbohydrates and with fats. They can for a restricted period form a substitute for proteins and maintain the organism, but the addition of proteins, in one shape or another, is absolutely necessary to keep up the equilibrium of health, although the quantity may be small.

Starch, which is widely distributed in vegetable foods, especially cereals and roots, including potatoes, is very similar to sugar as a nutriment, and is transformed in the body into a dextrin of sugar and into fat; it is as little a perfect food as sugar or fat.

The different kinds of *fruit* are mostly characterized by a large amount of water (80 to 90 per cent.) a varying quantity of sugar and dextrin (about 4 to 10 per cent.), some vegetable acids, a small quantity of starch (in some fruits only), and a considerable quantity of cellulose. Their digestibility varies according to their ripeness and the amount of acid and cellulose. *Ripe* and *tender* apples, pears, grapes, currants, gooseberries, cranberries, raspberries, figs, cherries, plums, apricots, oranges, peaches, bananas and tomatoes, are to

most fairly healthy people easily digestible, if taken in moderate quantities, but not when the stomach is already filled with other food, as it often is after dinner. They are most suitable with a simple breakfast and a small lunch. Many people have improved their health by always taking at breakfast soft raw apples.

Several fruits, like strawberries, exercise an injurious influence on some people, causing urticaria, eczema, and gouty affections. Many persons suffer from flatulency and diarrhœa after raw fruit, while they are able to bear it cooked. By cooking, however, part of the fruit salts is lost, and with them some of the usefulness. In apples this can to a great degree be avoided by simply baking them in their skins, instead of boiling or stewing them when peeled; but even in this way they lose some of their aperient action.

Many people think that fruits, green vegetables, roots and tubers are of little value for the nutrition of the body, because they contain so small a quantity of protein; but they are very useful by the alkaline bases they contain, which combine with the excess of acid in flesh food and pulses. Some fruits, however, contain a much larger amount of nourishing materials than others. Thus the fresh bananas contain about 22 per cent. of carbohydrates and 1·5 per cent. of protein; the dried figs between 60 and 70 per cent. of carbohydrates and 3 to 4 per cent. of protein; dried dates over 70 per cent. of carbohydrates and 2 per cent. of protein; dried raisins 70 to 75 per cent. of carbohydrates. These fruits require only a small addition of milk, or bread, or cheese to enable them to maintain life.

It is of great importance with regard to fruit, to avoid the introduction into the body of impurities—microbic and parasitic—attached to them. With some, such as apples, pears, peaches, bananas, this can be avoided by peeling them, but with others, such as raspberries, currants, grapes, especially strawberries, &c., it is difficult to escape some degree of danger, excepting by the greatest care in washing, and even this does not give perfect safety. The same is the case with green salads and other uncooked green vegetables.

The various kinds of *spices* (condiments) such as mustard, pepper, nutmeg, cinnamon and cloves, are to most healthy persons quite unnecessary, but are useful to some people with delicate appetite by stimulating the secretion of the digestive fluids and increasing the appetite. The habit of taking large quantities of mustard, pepper and pickles cannot be recommended. I have repeatedly seen a kind of catarrh of the throat and stomach (spice catarrh, catarrhus condimentosus) which only yielded after the entire discontinuance of spices.

Inseparable from food, and essential to the nutrition of the animal body, is *common salt* (chloride of sodium). Almost all foodstuffs contain certain quantities of common salt as well as of other salts (of potassium, calcium, magnesium and iron) which form part of the animal body, and only few articles, especially vegetables and fish, require an addition of salt. The addition of a small quantity to soups, eggs,

rice, potatoes, &c., is, however, not injurious, and is, to many persons useful, since it renders some food substances more palatable, which is an important point ; but the habit of adding large quantities of salt to all articles of food cannot be recommended. The excess may be harmless to some persons, but to others it is injurious, especially to those suffering from renal disease and the gouty. In most persons with a tendency to eczema, this is increased by the use of much salt. Large quantities of salt are said to increase the blood-pressure and to assist, therefore, the development of arterio-sclerosis. In all cases with high blood-pressure the adding of salt to the food at table ought to be restricted. On the other side the suspicion that the use of common salt may predispose to cancer is entirely without proof.

The *drinking water* deserves more consideration than it usually receives. Water may be regarded as a nutriment, it forms a large part of the human organism (about 63 per cent.), and the intake of a certain quantity is absolutely necessary for the various processes of nutrition, metabolism and excretion. The amount required for an average person under ordinary circumstances is about 3 to 4 pints in the twenty-four

hours. A great part of this is, however, not taken in the shape of drinking water, but is contained in the various articles of fluid and solid food, meat, green vegetables, fruit, milk, tea, coffee, wine, and beer.

The quantity of water required varies considerably according to the external temperature, the force of wind, the humidity of the air, the exercise, &c. To many persons the time when the water is taken is a matter of importance. Corpulent persons who want to become thinner, or those inclined to undue *corpulence*, ought not to drink at meals, but ought to take the fluid they require away from meals, night and morning or an hour before or after meals. Also many others, who are not fat, digest their meals better when they take them rather dry. A glass of water, cold or hot, according to circumstances, at bedtime and in the early morning, is very useful to most persons.

I cannot enter upon this subject thoroughly, but may say that the water ought to be almost free from organic matter, and to contain only a small quantity of inorganic matter, say not more than about $\frac{1}{4}$ grain of lime and 1 grain of common salt, and not much carbonic acid. The fear that soft water or rain-water properly

collected and stored, free from impurities, is injurious, is unfounded, but rain-water collected in large towns is rarely pure and ought to be filtered and boiled. Hard water, especially when it contains much sulphate or carbonate of lime, causes in some persons constipation, and in some urinary concretions, possibly also gall-stones. Some authorities think that chalky water may cause calcification of the small arteries, but this is not proved. The water arising from granite, gneiss and sandstone agrees best with most persons.

The weakly mineralized, *sparkling waters*, often called *table waters*, so much in favour at present, are to the majority of persons unnecessary, and when taken at meals are apt in many persons to cause distension of the stomach by the development of gas. They are better borne, and to some persons beneficial, on an empty stomach or between meals. When the ordinary water is pure, it is as good as, for many preferable to sparkling waters ; but when its purity is doubtful, natural sparkling waters form a good substitute, provided they contain only a small proportion of salts, such as Selters, Fachingen, Apollinaris, Rosbach, Johannis, Perrier, St. Galmier, &c. By taking the

ordinary water filtered and thoroughly boiled for four to five minutes the dangers of its impurities are minimized. Filtering alone is mostly unsafe.

It is impossible to lay down strict rules of diet suitable for everybody, as the rule which is good for one is unnecessary and sometimes injurious to another. Articles of food which cause indigestion in one person, or at a certain period of life, or in a certain condition of a person, as for instance beef, eggs, lobster, strawberries, or mushrooms, are perfectly well borne by another person, or even by the same person under changed conditions. Many people say that the best rule to follow for every one is to take what agrees with him, and not to trouble himself about other rules; but this best rule is not quite as safe as it appears. Lord Bacon expresses this in his own way in the essay "Of Regimen of Health." "A man's own observation, what he finds good of, and what he finds hurt of, is the best physic to preserve health; but it is a safer conclusion to say, 'This agreeth not well with me, therefore, I will not continue it,' than this, 'I find no offence of this, therefore I may use it'; for strength of nature in youth passeth over many

excesses which are owing a man till his age." The correctness of this remark we witness every day. A man, for instance, may daily take large quantities of meat and alcohol and may feel quite well with it and think that it agrees with him, and that he may take it regularly and in any quantity he likes, while he all the time prepares future trouble for himself. If one intends to lay down rules, one has to study in every person the constitution, the size, height and weight, the age, the degree of activity—mental and bodily—the individual peculiarities and the influence of habit, and to arrange the quality and quantity of food accordingly.

One rule, however, we can lay down with perfect safety, viz., that *great moderation in the amount of food*, and especially of the most nourishing articles (flesh food, cheese and pulses), ought to be practised by everybody, particularly by old people, and that this moderation is a great aid to longevity ; but the term "moderation" must have a different meaning for different persons and conditions, and is to be judged individually. Many people think that they may eat large quantities of highly nutritious food if they abstain from alcoholic stimulants, but this is a great mistake.

In acting on this erroneous view they, or at all events most of them, gradually develop changes in their blood-vessels which do not come to their perception at once, but for all that take place, and later on show themselves as gout, dilatation of the heart, arterio-sclerosis, glycosuria, disease of the kidneys, the liver, &c., &c. Professor Baeumler has well explained this in his recent contribution on arterio-sclerosis. An unnecessarily large amount of food, especially flesh food, often, by developing disease of the minute blood-vessels, impedes the flow of blood to the tissues, and causes, in fact, their starvation, while a limited, but sufficient amount, which is often erroneously called "starvation diet," improves and maintains their nutrition. *Superabundance of food leads, in fact, more frequently in the course of time to starvation of tissues than what is often misnamed "starvation diet," which helps to maintain them in a healthy condition.*

It has been observed by others as well as myself, that amongst great eaters, especially meat-eaters, there are some sufferers from anæmia (probably from alimentary auto-intoxication), and that this anæmia is increased by continued excess of flesh food. In this respect, some experiments on rats by Dr. Chalmers

Watson [131] are interesting. Watson found that the bones of young rats fed entirely on meat became soft, and that the bone-marrow became diseased; as the latter is intimately connected with the formation of blood, the anæmia of some great meat-eaters may possibly be explained by the result of these experiments, but we require further facts on this subject. The scientific basis of our knowledge of nutrition is, at present, but small, our teaching must still be based to a great degree on empiricism. The experience of all those, however, who have occupied themselves thoroughly with this question of food and nutrition, shows that safety lies only in moderation. Sir Michael Foster, for instance, says that "there can be little doubt that the ingestion of food—and perhaps especially of protein food—in excess of what is, under the best conditions, sufficient for maintenance and activity, can only be deleterious to the organism, clogging it with waste products which may at times be of a directly toxic nature." Sir Henry Thompson was in the habit of saying, with regard to excessive eaters, "they dig their graves with their teeth." I may refer also to the two cases mentioned on pp. 109 ff, and the remarks of

Sir Lauder Brunton that the ages reached by old persons maintained in workhouses are often very great. "A workhouse diet," he adds, "may not be very pleasing to the palate, but it certainly seems an efficient means of prolonging life, and it might certainly be worth while sometimes for others to adopt it whose circumstances would allow them to indulge in luxury." I further direct attention to the remarks on "overfeeding" made by Dr. Hutchison in his work on "Food and Dietetics."

Often it has occurred to me in practice that persons eating largely and constantly suffering from various troubles—dyspepsia, headaches, neuralgia, rheumatism, &c.—when placed for several months on a reduced diet, got rid of all their ailments; many of them afterwards, when returning to their usual diet, began again to suffer, but recovered almost immediately on diminishing their intake.[1]

As a proof of the beneficial influence of great

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[1] L. Cornaro [29] already remarked, that whenever he was induced by his friends to take more than his usual small allowance, he began to suffer in various ways, and that all his troubles disappeared when he returned to his limited diet.

moderation, I may mention the experience often made that persons with very delicate digestion from an early age onwards, who could take but very small quantities of food, only one-third or one-fourth part of what the rest of their family and the majority of people took, and only special kinds of food, such as milk, cream, light puddings, eggs and the smallest quantity of boiled chicken or whiting, without suffering, usually remained free from gout, rheumatism, neuralgia and other complaints, and lived much longer and enjoyed a much healthier old age than the more vigorous companions of their youth, who could and did eat large quantities of food with enjoyment and with *seeming* impunity.

Many years ago I observed on myself that the reduction of the amount of food, especially meat and other flesh food, to half the quantity I had been in the habit of taking, enabled me to do a larger amount of work without the feeling of mental fatigue and exhaustion, and craving for tea or coffee some hours after a meat lunch. When afterwards patients complained of fits of yawning, sleepiness, and inability to do good literary work during some hours after a heavy breakfast and lunch, I induced them to substitute light

breakfasts and lunches without or with very little flesh food, with the almost constant result of the entire disappearance of the inconveniences formerly felt. Dr. Sealy met with the same experience, and he mentions besides that his patients enjoyed the less substantial and less voluminous meals much more than the large and more nourishing ones which they had previously considered essential to their health. He also points out the great improvement caused by this plan in the circulation, the nervous and digestive functions. He suggests that much nerve force is used up by the digestion and assimilation of large quantities of flesh food, and that the nerve force saved by the lighter meals becomes available for other functions. I may add that I have almost invariably observed also an improvement in the *complexion* of persons who had exchanged light meals, with less meat, for the heavy meals which they formerly had been accustomed to.

Most persons indulging a large appetite, whether abstainers from alcohol or not, if you tell them that they must reduce the amount of food, must take only little meat and flesh food and alcoholic stimulants, think that you are going to starve them, that it is

impossible for them to do their work on reduced allowances. They are mostly confirmed in this view by their relatives and friends, especially by ladies. They ascribe any feeling of lassitude, headache, neuralgia, disinclination to active work, although this is very common in persons taking too large meals, to the diminution of alcohol and meat, and under this impression discontinue carrying out your suggestions. It is quite true that in some people such reductions, when made too suddenly, have unpleasant effects, temporarily; but if the reduction is made gradually, the body becomes easily accustomed to it and the mind too. Some of the inconveniences felt are with many persons due merely to the fear of being lowered. Experience in many hundreds of cases authorizes me to say that more or less gradual reduction, carried out with judgment and perseverance, leads almost always to increase of mental and physical power, greater resistance to disease, cheerfulness, and the prevention of premature old age and the sufferings connected with it. The majority of Japanese live in perfect health, and perform a large amount of work on so small an amount of food as the majority of Europeans would consider insufficient to

maintain vigorous life. Few people know how little food is required to maintain health, especially in advanced age. Professor Chittenden's [26] experiments at the Yale University indisputably show that the amount of food required for the maintenance of perfect health and strength is much smaller than had previously been assumed. In Chittenden's experiments the quantity of meat, and all other flesh food and eggs, was reduced to a small proportion of the entire intake. Amongst the results arrived at by the "Collective Investigation Committee" we find that only few (5 per cent.) of the persons above 80 years had been large eaters of animal food, and that the majority had eaten only little meat (Professor Humphry, [60]), and this is the result of my own experience. The late Sir Henry Thompson has given excellent advice in "Diet in Relation to Age and Activity," and not less so the late Dr. George Keith in "Plea for a Simpler Life" [67]; but their lessons are not acted upon by the majority. As long ago as 1558, L. Cornaro, of Venice, showed by the description of his own manner of living, when he was more than 90, in his "Discourses on a Sober and Temperate Life" [29], how, on a very small amount of

food and wine, one can maintain perfect health and happiness, and reach a very advanced age. He lived to over 100, and died without suffering.

During my observations on this subject, extending over more than sixty years, I have been able to inquire into the manner of living and other antecedents of over 100 persons living to between 86 and 100 years. Although most of these persons belonged to the well-to-do classes, and were not obliged to restrict themselves, there were not more than six amongst them who had more or less habitually indulged themselves by eating or drinking largely ; many, on the contrary, were remarkable for great moderation in both eating and drinking ; some lived almost entirely on vegetables and fruit in large quantities, with the addition of milk, cheese, butter, and occasionally eggs, and only quite exceptionally took meat, fish and poultry.

Vegetarians, strict as well as modified, can attain long life and can perform the same amount of work as meat eaters and mixed food eaters ; and it is at present less difficult to live entirely on vegetable food than it was in former years, since great progress has been made in the cultivation and cooking of vegetable foods

agreeable to the palate, but I have not been able to convince myself that in the very great majority of fairly healthy people a moderate amount of meat, fish, poultry and game causes any bad effects. At the same time I must again state my conviction, based on ample experience, that most people enjoy better health and live longer with only little meat and flesh food, and the substitution for the reduced meat allowance of a larger quantity of green vegetables, to which milk and milk products, and eggs, may be added with advantage. It is especially in advanced age and in persons suffering from gout, chronic rheumatism, arterio-sclerosis and diseases of liver and kidneys that meat ought to be taken very sparingly. Not only in graver diseases, but also in some minor complaints, meat, including poultry and fish, in large and even in moderate quantity is not well borne. There are some people who cannot bear meat, and others on whom fish exercises an injurious influence. I have often succeeded in curing eczema, acne, roughness and scaliness of the skin, and fœtor of breath, by total abstinence during months and years from flesh and fish, and the substitution of vegetables, especially green vegetables, milk, cheese and eggs with moderation. Not rarely

this diet led also, as already mentioned (p. 100), to great improvement of the complexion. It is worth mentioning that according to recent researches the vegetable albumins show greater resistance to poisonous bacteria than the animal albumins, and therefore are probably less prone to cause auto-intoxication [A. Rodella, 110]. Excessive eating occurs also amongst vegetarians, especially those who consume large quantities of pulses, and it produces similarly injurious effects as excess in meat eaters.

Some morbid conditions and dispositions such as headaches, neuralgia, gout, epilepsy are much improved and often cured by a purin-free diet; but this diet does not suit everybody, and occasionally, though rarely, it loses its effect after some months or years.

Dr. A. Haig [49 and 50] gives some judicious instructions about diet, but the very strict rules laid down by him, entirely excluding meat, tea and coffee, although well suited for some exceptional persons, are certainly *not necessary* for *all*, even not for the majority, and I may add that I have seen a number of persons who, after having conscientiously tried Dr. Haig's restricted diet for many months, were obliged to return to a moderate addition of animal food,

on account of loss of strength and weight, although possibly, if they had been able to overcome their dislike to milk and its derivate articles of food, they might have better succeeded. To this question of food, as to so many others, Goethe's words are specially adapted :—

"Eines ziemt sich nicht für Alle,
Suche Jeder wie er's treibe."

("One plan does not suit all,
Each must try how he fares best.")

Or better :—

"What is fit for A is not fit for B ;
Let everyone to his own course see."

The same truth is also tersely expressed by the old English adage, "Every man is a law unto himself."

To give only a single instance: persons who are too fat or inclined to corpulency or obesity must avoid sugar almost entirely, while other healthy persons may indulge in it ; they must also restrict themselves in starchy foods such as potatoes, cornflour, cakes, white bread, while others may almost live on them.

It must also be borne in mind that the circumstances in which persons live, the environments, especially temperature, and the amount of wind, exercise some influence on the quantity and quality of food they require.

The cost of different kinds of food is likewise to be considered. The same food value can be obtained at different prices, and according to the means at disposal less expensive or more expensive kinds can be selected.

We must, however, not think that the food value can be judged entirely by the chemical constituents ; and, in addition, the personal factor in this matter, too, is of importance. Experiment and experience also show that the mixture of several articles of food is more nourishing than the single articles taken alone ; for instance, bread and milk taken together are more nourishing than bread alone and milk alone. One article of food increases often the digestibility of another. We can learn much from farmers on this subject.

A very strict adherence to stringent rules of diet is not necessary to healthy persons ; it may even cause a species of hypochondriasis. A healthy man has arrangements in his body which allow him great latitude in dietetic and hygienic matters, without causing harm. The powers of adaptation and compensation are in strong constitutions very great. What is desirable is the acquisition of a *habit of living* adapted to the individual, which

may be acted upon without constantly asking oneself, "Will this do me good or harm?" Even persons with delicate digestion can acquire this habit.

Many persons assert that the teeth and the digestive tract of man point to his requiring a large share of flesh food in his diet. This is by no means in accordance with *fact;* the teeth, jaws and intestines resemble much more those of herbivora than those of carnivora. They are similar to those of monkeys, which thrive better on vegetable than on flesh diet. It is well known that some monkeys which never have taken any meat possess great strength, for instance, the orang-utang and the gorilla, whose teeth and intestinal organs closely resemble those of man. From this alone we might infer that meat is not necessary for strength in the human being, and experiment proves the correctness of this inference; but I see no reason to say more than "not necessary."

If we examine the longevity of animals we find some herbivora very long lived, like the elephant and the parrot, others short lived, like the hare and the monkey; some flesh feeders, like the hawk and the eagle, are rather long lived; others, like the fox, short lived. We can

therefore draw no inference from this comparison with man.

Those who maintain that a large quantity of flesh food is necessary for average mental and physical vigour are more wrong than those who forbid it entirely.

Excess of food rich in proteins causes, as Sir W. H. Allchin justly says [5], often lassitude, want of energy, headache, constipation, skin affections and feebleness of the heart.

Quantity of Food.—An important question, which is still under discussion, is the amount of food required by healthy persons. Voit, Playfair, and other physiologists have made elaborate experiments and have stated in figures the amounts necessary, which had been adopted for many years as the standard; but Horace Fletcher [45], Chittenden [26], and others have shown that health and vigour may be maintained by a much smaller quantity. For public institutions, prisons, asylums, &c., it is necessary to fix a dietary, but for private persons, we have to take into consideration the great differences which exist between different persons, such as height, weight, shape of body, age, constitution, temperament, proportion of muscle to fat and bone, physical and mental exercise and habit. We have also

to take into account the surroundings, meteorological conditions, climate, season and other matters.

I cannot say how little is required, but I venture to record here two cases which, although they are not accurate enough for scientific value, give a fair idea of the small quantity of food required for the maintenance of perfect health :—

L. T., aged 61, consulted me first in November, 1872, on account of attacks of gout and hæmorrhoids. His father had died of apoplexy, aged 66 ; his mother of cancer at 68. He was himself a powerful man, 6 ft. 1 in. in height, weighing 13 st. 5 lb. He was a country gentleman with literary tastes ; took much meat and little exercise and slept about ten hours a day. He suffered from frequent attacks of gout, constipation, hæmorrhoids and dyspepsia.

Advice : Daily breathing exercises, daily walks of two or three hours. Less meat, more green vegetables, restriction of alcoholic stimulants to 1 oz. of whisky. Four ounces of Friedrichshall bitter water three times a week for two months. To sleep not over seven hours.

In the course of a year the weight diminished by 12 lb., and he was altogether better ; but he had had several attacks of gout. He then left off butcher's meat entirely, and alcoholic beverages almost so. In May, 1874, he was further improved ; but he was not satisfied with the gain, as he felt

sometimes heavy, sleepy, unfit for mental work, and we settled on the following diet (for twenty-four hours):—

4 oz. fish or poultry,
1 pint milk,
2 oz. butter,
8 oz. brown bread,
6 oz. potatoes,
12 oz. green vegetables,
2 or 3 apples,
1 oz. whisky.[1]

On this diet, to which he kept very strictly, and which was carefully superintended by his intelligent local doctor, the attacks of gout disappeared entirely, and he kept perfectly well until 1880, when he became mentally depressed by the death of his only brother from apoplexy (aged 67) and a sister from pneumonia (aged 65). After travelling for some months he regained his cheerfulness and remained well till the autumn of 1890, when chronic bronchitis developed itself. He could not be induced to go to a warmer climate, and died in December, in his eightieth year.

F. W., aged 49, came under my observation in March, 1871. His family history was not good: father had died, aged 65, from "dropsy"; mother, aged 61, likewise from "dropsy." Of his three brothers, two were gouty, one had died from phthisis. He led an active life in the country—fishing, shooting and rowing. He had during the last five years rather frequent attacks of old-fashioned "podagra."

[1] The whisky was left off in August, 1874.

He took a large quantity of animal food, and about 1 pint of port or sherry or champagne daily. Height, 5 ft. 5 in.; weight, 11 st. 5 lb.; red face, large stomach—a condition which some German physicians call "abdominal plethora." The urine contained traces of albumin and large amounts of uric acid and urates, with medium specific gravity. After a course of treatment at Carlsbad the albumin disappeared, the stomach became natural, and he felt well; but later on the attacks of gout returned, and in 1874 he consented to the following plan of diet, which his doctor in the country carefully superintended, weighing the food at intervals. Ration of food for twenty-four hours:—

3 oz. meat, or fish or poultry,
6 oz. potatoes,
16 oz. green vegetables,
16 oz. milk
6 oz. brown bread,
1 oz. butter,
2 small cups of weak tea,
Half a bottle of Zeltinger (Moselle).

This diet he adhered to with only rare intervals, and whenever he took a larger quantity he began to feel less well. He took regular breathing exercises, much open-air exercise, besides some work in his parish and county, and became free from gout. After his seventieth year he further diminished the quantity of food and left off wine; he died at the age of 81 in his sleep. Both his brothers had died before they were 67, from "gouty complaints," after protracted illness.

The health of these two men, to which I could add many others, we may assume, was much improved and their lives were prolonged by the change of diet from abundance to great moderation. In neither case was the family history good, and both outlived all their near relations by many years. We also see that much less food is required for maintaining health and vigour than is taken by at least nine persons out of ten. It is very probable that the food taken by these two men might have been further reduced, if it had been necessary ; but as they enjoyed perfect health and strength, there was no reason for trying an experiment. It is scarcely necessary to add that I do not ascribe the prolongation of life in these cases to the reduction of food alone, but that I attribute also a share to the breathing and other exercises.

I am not in favour of restricting the amount of food to the minimum necessary for the maintenance of life, but allow a slight margin of excess, if it is well borne.

I will also mention a rough estimation of the daily rations which I have found satisfactory by prolonged observation and experiments made sixty-six years ago on six men in good health, including myself, aged between 22 and 35,

5 ft. 7 in. to 5 ft. 9 in. in height, weighing between 140 lb. and 156 lb. These men did every day mental work during six to eight hours, and walked between 4 to 6 English miles. They carried out this way of living during three to six months, with intervals of several days every three or four weeks. They maintained perfect health during the period of experiment, and did not vary more than 1 to 2 kilos, or 2 lb. to 4 lb., in weight from the beginning to the end. They were medical students and young doctors at Bonn.

The rations consisted of about :—

Milk, 30 oz.

Cooked meat, 6 to 8 oz.

Cooked green vegetables and fruit, 16 oz.

Bread, 16 oz.

Potatoes, 6 oz.

Butter, 1 to 2 oz.

Water, about 50 oz.

The fluid was consumed partly as pure water, partly as coffee, tea, wine or beer (rather less than a pint of either, not of both).

Further experience has shown me that the rations mentioned are *more than sufficient* for healthy adults in the middle ages of life, of average weight, doing a moderate amount of

physical or mental work. Thus, for instance, I have suggested to many adults, of average size and weight, men as well as women, a daily diet consisting of about ½ to 1 pint of milk, 2 to 4 oz. of meat, or fish or poultry (or, instead of meat, 1 or 2 eggs and 1 to 2 oz. of cheese), 2 oz. of fat, 1 oz. of sugar, 10 to 15 oz. of bread, 10 to 16 oz. of green vegetables, 4 oz. of potatoes, or 1 oz. of rice, 6 to 8 oz. of fruit, ½ pint to 1 pint of weak tea, or coffee, or cocoa. Slight differences were made according to size, weight, age, amount of work, &c. Almost all felt perfectly well with this diet, and were able to do much work, mental and physical. Some, who were too stout lost at first 5 to 10 lb. and even more, but when they had descended to their normal weight they scarcely changed afterwards. Others, who were too thin, gained weight and then kept to it.

Almost all authorities are agreed on the subject that in *old age* the amount of food ought to be very *limited*. Lord Bacon says: "Discern the coming on of years, and think not, to do the same things still, for age will not be defied." Dr. George Cheyne says in one of his rules: "The aged should lessen the quantity and lower the quality of their food

gradually as they grow older—even before a manifest decay of appetite forces them to it" [25]. There are, however, in this respect too, great differences in persons of the same age. A man of 80 who takes a comparatively large amount of physical and mental exercise, can and ought to take a larger quantity of food than a man of the same age who does scarcely any physical or mental work. *Activity* allows and requires more food than *inactivity*.

With advancing years the tendency to arteriosclerosis and other degenerations of the small blood-vessels frequently shows itself. One of the prominent signs is increased blood-pressure, to which Sir Clifford Allbutt has recently directed attention [2, 3, 4]. This symptom, combined with others, ought to be a warning that the amount of food ought to be reduced, sometimes even restricted to milk and vegetables. If the disease is in an advanced state, the benefit can only be limited. *Prevention*, as Sir William Osler quite lately said in his lecture on angina pectoris, is the wisest rule, and this is effected by great moderation, especially in flesh food and in stimulants, assisted by a certain amount of physical exercise adapted to the condition of the body. We must bear in mind

that the metabolism in old age is much diminished, that the mucous membrane of the intestinal tract and the various digestive glands undergo in old age a certain degree of atrophy, and that the cells of the different tissues and organs of the body have a more limited power of assimilating and decomposing nutrient materials (von Noorden, Ebstein, &c.).

Erroneous ideas are often entertained by the public with regard to the external appearance and the weight of the body. Many old persons are alarmed by their becoming thinner, and, to avoid this, think they must eat more ; but this is mostly quite wrong. In the majority of cases increase of weight after 70 or 75 is not good, and corpulence where it occurs is to be counteracted by restriction in food, by exercise and other means. A slow decrease in weight is mostly observed in those who reach a very advanced age. The old saying *corpora sicca durant* remains good to this day.

It is not only the *quality and quantity of food which we take, but also the manner in which it is taken, on which health depends.* Food ought not to be taken when the mind or body is exhausted by overwork ; rest ought to precede the meal under such conditions ; further,

if possible, food ought not to be taken while the mind is in a state of anger or violent excitement.

Food ought not to be taken either too *hot* or too *cold;* but much depends on the nature of the food and the personal condition of the person. During cold weather, food between 92° and 100° F. is most agreeable. Food above 115° impairs the peptic fluids of the stomach. Ices and iced drinks ought to be avoided or taken only very sparingly by delicate persons.

All important is *thorough mastication*, a subject constantly preached, but almost as constantly neglected. Many forms of indigestion and of serious disease of the stomach and intestines, many states of imperfect nutrition of the whole body, are caused by imperfect mastication and by what is called *bolting the food.* Quite lately Dr. Harry Campbell [21], Dr. van Someren, of Venice, Mr. Horace Fletcher [45], and others have again directed attention to this matter in a judicious and forcible manner. Sir Lauder Brunton justly points out the possibility that imperfect mastication may be a cause of cancer of the stomach through the irritation of the mucous membrane by hard particles of insufficiently masticated food. Combined with

the fault of bolting is often that of *washing down* the food before it is properly masticated, a grave mistake committed frequently by large eaters and by those who take much fluid during the meals, which in itself, as remarked before, is an injurious habit. No food ought to be swallowed before it has been transformed by mastication and admixture of saliva into a thin pap. Many articles of food, especially those containing starch, are imperfectly digested unless they have been thoroughly mixed in the mouth with saliva, by which the starch is transformed into dextrin. Even fluid or half-fluid food, such as porridge, gruel, soups, coffee, tea and chocolate, ought not to be gulped down rapidly, but ought to be taken slowly, so as to allow them to be mixed with saliva. It is the habit of many people to neglect this rule, and to forget that the process of digestion does not commence in the stomach but in the mouth.

Amongst the great benefits of thorough mastication is the diminution of the formation of gas in the stomach and intestines (flatulency), and, further, the prevention or great limitation of putrid fermentation of the food in the intestines.

Another effect of mastication is that less food

is required, because more of the quantity taken in is absorbed, and for the same reason the bulk of fæcal matter is diminished, and the evacuations may become less frequent without the disadvantages of retention.

As proper mastication is one of the most powerful and beneficial means of maintaining health, it is self-evident that the organs of mastication, *especially the teeth* and the jaws, ought to be carefully attended to from early life to old age. Children ought to be taught to brush their teeth after meals, and before going to bed, in order to remove the remaining particles of food which undergo acid fermentation with the formation of numerous bacilli and thus cause decay of the teeth. We must leave this subject to dentists, but we must insist on the importance of instruction on the management of the teeth in children as well as adults, on the regular examination and treatment of the teeth of school children, and the use of good artificial teeth after the loss of the natural teeth wherever they can be afforded. This, we hope, will be facilitated by the manufacture of cheaper artificial teeth.

A weighty matter which is often overlooked in rules about diet is the *condition of food*, viz.,

that it is in a wholesome condition, clean and fresh, not approaching mustiness or putrescence, not contaminated with organic or inorganic noxious substances. Part of this ought to be prevented by the public inspector, but even when bought in a wholesome condition, the articles of food are often deteriorated in the house by exposure to dust, to flies, to microbes in the air ; or are allowed to become stale and putrescent before they are used. The storage of the food is a most important matter. It is impossible to bestow too much attention on these points. Some of the dangers to the body are avoided by cooking, but not all.

It would lead too far to enter here on the *cooking of food* by roasting, boiling, baking, frying, stewing, and other processes, although this is an important matter. I must, however, allude to one or two points which are frequently ignored. It has been shown by experiments that some kinds of food become by cooking more, others less, digestible. The amylaceous vegetables, such as potatoes, rice, maize, cereals, gain in digestibility by cooking and baking, since through it the cellulose coating, in which the starch granules are enclosed, is burst, and the granules thus become exposed to the action of

water (hydration) and to the digestive ferment (ptyalin). All the vegetables rich in cellulose are rendered more digestible by the process of cooking. Many, however, lose some of their salts and soluble substances, which pass into the water in which they are boiled. Stewing is therefore preferable to ordinary boiling, whenever it is desirable to retain all the constituents of the vegetables. Most animal foods, on the other hand, are somewhat impaired in their nourishing value by cooking, as heat approaching the boiling point coagulates the proteins and renders the fibres of meat harder and less digestible. As, however, most people feel great repugnance against raw flesh, and as, besides, raw meat contains sometimes injurious parasites, we must endeavour to use methods of cooking by which the taste of rawness and the danger of parasites are removed, while the fibres retain their tenderness and the flavour is not destroyed. This is attained by exposing meat and poultry only for a few minutes to a temperature of 100° C. (212° F.) or more, and thus produce a kind of crust which prevents the loss of juice from the interior, and then continue the cooking process at a lower temperature—not exceeding 180° F.—for a longer period. Altogether the

process of long cooking at a low temperature renders the flesh tender and preserves the natural flavour. This object can be obtained by the process of roasting and also by that of *stewing*, which latter has the great advantage, besides rendering the fibre tender, of preserving all the salts and other ingredients, if the stewed meat is taken together with the juice. The process of boiling is less to be recommended than that of roasting, because more of the salts and extractive matters is lost by boiling than by roasting. For gouty persons, however, to whom the extractive matters of meat are injurious, tender boiled meat is preferable to roast.

One of the beneficent influences of cooking is the destruction of pathogenic microbes, such as the bacillus of tuberculosis, of typhoid fever, cholera and scarlet fever in milk and water ; though it cannot be denied that also friendly bacilli are destroyed by cooking. In addition to bacilli also larger parasites are rendered innocuous by the process of cooking, such as trichinæ and tapeworm.

Salt beef, which is a favourite article of food with many people, cannot be recommended ; it contains too large a quantity of common salt while it is deprived of some of its original salts

important for the organism, and the fibres are less tender than in stewed meat. The frequent occurrence of scurvy amongst sailors on long sea voyages in former years was probably due to the large proportion of salt meat in their diet without the addition of vegetable substances rich in potash and vegetable acids.

It is necessary to render the food not only as *easily digestible* but also as *palatable* as possible, since the act of eating ought not to be a mere duty, but also a source of pleasure. The enjoyment of food causes an increased flow of saliva and gastric juices, and thus greatly assists the digestion. Delicate persons with poor appetites and convalescents from acute diseases ought to be indulged with articles of food which they like and which are cooked according to their taste as far as the condition of their digestive organs allows. It is further important to provide a certain degree of *variety* of food, for constant sameness of food destroys in some persons the appetite and causes even actual dislike. The liking or disliking of food causes increase or diminution in the secretion of gastric juice.

In urging the necessity of careful preparation and palatableness of food for delicate persons, we

must, however, not fall into the other extreme, against which Metchnikoff justly protests : " I shall content myself with saying that most of the delicate dishes provided in the homes, hotels, and restaurants of the rich stimulate the organs of digestion and secretion in a harmful way. It would be true progress to abandon cuisine, and to go back to the simple dishes of our ancestors."

For most persons, excepting the strongest, it is desirable that they should avoid exertion of mind and body just before, during, and soon after the principal meals, so that the stomach receives as well the blood as the nerve power necessary for the digestive processes.

It is often said that persons doing a large amount of brain work require a great quantity of food and stimulants ; but careful observation does not prove this to be the case. I have known many hard brain-workers who did their work best when they ate and drank very little. Dr. Keith, in his "Plea for a Simpler Life" [67], mentions that Sir Isaac Newton, Napoleon, and Wellington took scarcely any food while they were engaged in great problems. Several of my own friends, occupied during long periods in arduous literary work, took while thus engaged much less food than at periods of

leisure, since they had found that they worked much better with little than with much food.

The proportion of the different kinds of food ought to be arranged according to the peculiarities of the body. Persons with a large mass of muscle have a greater waste of nitrogenous matter than persons with small muscles ; the former require a larger proportion of nitrogenous food (proteins) than the latter in order to maintain the equilibrium.

The distribution of the food consumed during twenty-four hours can be varied considerably according to constitution, state of health, occupation, social custom and personal habits. A few strong persons can take all their food at one meal, others require only two, but the majority feel best with three, and some do not feel well with less than five ; the latter is especially the case during convalescence from acute disease and in neurasthenics and weakly subjects. Too many meals interfere in most persons with the secretion of the digestive juices and lead occasionally to emaciation. For the majority of persons it is best to take the two principal meals without, or with very little, fluid, and to take a tumblerful of water, hot or cold according to circumstances, an hour before or after meals, or

only night and morning. In whatever manner the food is distributed over the day, it is essential that *sufficient time* is allowed for each meal, so that mastication can be thoroughly performed, and that the principal meal is placed at the period of the day when this is most likely to be the case, and when the mind and body can be quiet, for "unquiet meals make ill digestions" (Shakespeare's "Comedy of Errors," act v, sc. 1), and when hard labour—mental and physical—can be avoided for some time after the meal. Some persons maintain that there ought to be no regular hours for meals, but that food ought only to be taken when there is a feeling of hunger. This may be satisfactory for some independent people who live alone or need only think of themselves, but those occupied in offices or manufactories, in the Navy or Army, or in schools, or who live in families, must take their meals according to convenience, at more or less fixed times.

Finally, we must warn once more against over-anxiousness about the quantity and quality of food. Some persons do themselves harm by continually fearing to violate the rigid rules of living which they themselves or others have imposed on them.

VIII.—Alcohol.

On the much-debated and all-important question of *alcohol*, I will try to be as short as possible. It cannot be denied that alcohol causes to many people transitory enjoyment, by its taste, and by its exhilarating effect; but it is nevertheless true, as Sir Frederick Treves [126] says, that it is a poison which ought to be avoided by everybody, excepting in the smallest quantities; there can be no doubt that total abstinence from alcoholic beverages would greatly promote the health of the human race. *Alcohol is not necessary* to healthy persons, and most of them would be better without it. Many diseases of the liver, the kidneys, the brain, the blood-vessels and other organs are, no doubt, produced by the abuse of alcohol; many promising lives are destroyed by it; it is the most frequent cause of *crime* and of the ruin, not only of the drinkers themselves, but of their families and their progeny. Abuse of alcohol is, as Lord Brougham said, "the mother of want and the nurse of crime"; it is the greatest of all preventable evils affecting the public health. A large percentage of epileptics, imbeciles, idiots, criminals, persons

suffering from weak and early loss of memory and other mental deficiencies, melancholia, &c., is the product of intemperate habits. The mind is perverted by intemperance, the love of home and family and the sense of veracity and morality are destroyed. The bactericidal influence of the blood is weakened by alcohol and through this the resisting power of the body to disease. The great and early mortality amongst public-house keepers is well known, and is so general amongst all those who are engaged in the liquor traffic that insurance offices either decline their lives, or take them only exceptionally, and then only at very high premiums. The records of insurance offices further show that the lives of total abstainers are longer than those of non-abstainers. The tendency to dipsomania, to alcoholism in general, and to all its painful effects on mind and body is distinctly inheritable, and the descendants of inebriate parents ought, therefore, entirely to abstain from alcoholic stimulants. It is asserted that alcohol assists the digestion ; but this is the case only in some persons and only with regard to the digestion in the stomach, not in the rest of the intestinal canal.

Alcohol is also regarded by some men of

science as a valuable article of food, as an economiser of albuminous substances, but in truth it possesses this virtue only in a very small degree and it injures the metabolic power of the cells. Alcohol has further been praised as a producer of warmth ; but its warming effect is only transitory and is followed by the opposite, even by death, especially on long, cold journeys. The warming effect due to the combustion of alcohol is much outbalanced by the cooling effect produced by the dilation of the peripheral capillaries and the escape of heat through them.

The regular use of alcohólic stimulants by *young persons* which I have seen in some families, is especially dangerous, and ought to be counteracted at school as well as at home, since it stunts complete development and leads often to the habit of taking in adult life more than is conducive to happiness and to health of mind and body.

Alcohol, like other poisons, can be used as a *medicine* temporarily in various states of exhaustion ; it is a heart-stimulant. On this point I cannot fully enter at present, but I must state that it has been greatly abused in the last century, and that even now it is often too indiscriminately and too loosely recommended.

Above all things the exact quantity ought to be mentioned, the times when it is to be taken and how long it is to be continued, for otherwise the inclination to take too much and to continue it for many months and years may be fostered and the habit of drinking to excess may be and often is created. At the end of exhausting diseases, such as severe enteric fever, pneumonia, influenza, bronchitis, &c., when the nutrition of the heart has been much impaired, the pulse has become very rapid and weak, small doses of alcoholic stimulants frequently repeated are sometimes most beneficial and even necessary, but such cases form the exception, not the rule ; and the allowance of alcoholic stimulants must be withdrawn as soon as the necessity ceases. The arrangement which was common and which still exists in some hospitals, convalescent homes, and sanatoria, to give a certain amount of alcoholic stimulants as part of the daily diet, is reprehensible, and the use of alcohol in such institutions ought to be restricted to those for whom it is really necessary, or for whom it is prescribed by the doctor.

It is the habit with some persons of judging the influence of alcoholic stimulants on the constitution merely by the amount of alcohol

which they contain. This, however, is not correct. The other constituents of these beverages ought likewise to be taken into consideration. The fermentation of the malt and sugar by which the alcohol is produced is combined with the production of other substances. The so-called "*spirits*" of which brandy, whisky and gin are the ordinary types, most nearly approach in their influence on the body that of pure diluted alcohol; but they also contain various by-products of fermentation, which produce special effects. They are almost free from acidity and are through this more easily borne by some persons than wines; but it is important that they should be well seasoned, and recommended only with the safeguard previously mentioned. The different kinds of *wine* contain, in addition to alcohol, varying quantities of sugar, vegetable acids, ethers, essential oils, extractives, mineral matters, carbonic acid, &c., on which the effects of wine on the organism depend. It is impossible to enter adequately on this large subject. Alcoholic fluids containing a considerable amount of sugar, dextrin, hop extract, albuminous matter, salts, vegetable acids, and free carbonic acid and other substances, such as the different kinds of *beer*,

have not the same effects on the digestive organs, the nervous system and the organs of circulation as fluids which are more or less pure, diluted solutions of alcohol, such as those mentioned above. *Beer* owing partly to the purin bodies which it contains (Walker-Hall [130]) disposes some persons who take it regularly to rheumatic and gouty complaints, and by the saccharine substances to stoutness and the disadvantages and dangers attending it. The difference in the composition of different kinds of beer and in their action on the body is considerable. Professor Baeumler [9] further directs attention to the fact that persons consuming large quantities of beer mechanically overtax their blood-vessels by keeping them in a state of distension, which gradually leads to disease of the small arteries and of the heart, the work of which becomes more and more increased by the morbid state of the blood-vessels. My own experience amply corroborates Baeumler's view. Between 1850 and 1870 many young Germans engaged in the sugar-baking trade in the East End of London, came to the German Hospital suffering from various diseases, due partly to the excessive heat to which they were exposed from morning till

night, partly and even more commonly so to the almost incredible amount of small beer (eight to twelve gallons per day) which they took to quench their thirst; dilatation of the heart and hydræmia very frequently occurred, and in one man, scarcely 30 years of age, extensive atheroma of arteries, especially those of the brain. Ebstein in his treatise on the prolongation of life [37] likewise points out the injuriousness of excessive beer-drinking.

Small quantities of beer, however, not exceeding a pint in the twenty-four hours, are well borne by many persons who take much exercise, and are less injurious than the habit of taking whisky or brandy exceeding two to three ounces in the day; but the experience of careful and unprejudiced observers show that most persons are better without them. "As a rule," Sir Lauder Brunton says, "the most harm is done by spirits, and least by small beer and weak wines, such as those drunk by the peasantry abroad" [14].

Sometimes we succeed in combating the alcoholic habit by substituting for the usual alcoholic stimulants non-alcoholic beverages, such as lemonade, ginger beer, soda water, effervescing mineral waters, non-alcoholic grape juice, other

fruit juices and fruit syrups with water. The rough cider, too, though not quite free from alcohol, may be taken by many persons in fair health, in limited quantities, without harm, by some even with advantage.

In some men I have been able to diminish the craving for alcoholic stimulants by greatly reducing flesh foods, especially salt foods and salt itself; in others by greater moderation in smoking; again, in others by inducing them to take no fluid at all at meals, but to wait till an hour after meals, when they were less inclined to drink, sometimes forgot it altogether and gradually lost the habit of regularly taking stimulants.

A very prevalent idea with regard to alcohol, is that it is more useful to persons in advanced than in middle age, in fact, that "wine is the milk of old people," that it does for them what milk does for children. This doctrine is not in harmony with careful observation, and alcohol, excepting in great moderation, is even more dangerous to the aged than to the younger people. "It seems to me," said Dr. Parkes, "that there must be danger in the use of alcohol, when the arteries become rigid, in advanced life" [102, p. 295].

Alcohol habitually taken in any large quantity

injures, in most persons, the arteries and capillaries, the brain cells and nerve-fibres. It is well known that alcohol interferes with the cell-growth, especially in the liver, and partly through this, deteriorates the metabolism and the transformation of the purin bodies into urea. It diminishes the resisting power of the organism against chills, microbes and other causes of disease, and this resisting power is one of the great agents in the prolongation of life, and ought to be strengthened in every possible way, not weakened, as it is, by alcohol. We hear often that alcohol is not injurious if taken only in *moderation*, but it is the interpretation of this term which is fraught with so much danger. Many persons consider themselves moderate, if they never become drunk ; some take five or six glasses of sherry or port in the twenty-four hours, or two to three pints of beer, or three or four glasses of brandy or whisky, and consider themselves perfectly moderate. This is a very dangerous kind of moderation to the majority of people. An occasional, but rare, inebriation with intermediate abstaining is much less injurious than the regular use of the amount of stimulants just mentioned. Most persons who take more alcohol than is compatible with their health

do not feel any disadvantage from it for months and even years, and often not till actual changes in the heart and blood-vessels, or in the nervous system, have been produced. *The slow and insidious manner in which the regular drinking of so-called moderate, but in reality immoderate, quantities acts, is one of the causes of the frequency and danger of this error.* The fourth part of the quantity mentioned above is what I could call moderation, permissible to the majority of persons. It is a common fallacy to think that alcohol by its action on the brain enables the mind to work more quickly, and the body to undergo greater fatigue. Sir Victor Horsley [58] has shown that there is no foundation whatever for this view, and refers to Professor Kraepelin's scientific experiments, proving that alcohol even in small quantities interferes with the highest functions of the brain, that in large quantities it abrogates the controlling power of the brain and cerebellum. The increased activity of the mental faculties which is produced in some persons by alcohol is only of very short duration, and is rapidly followed by impaired and deranged action. Another fallacy is that alcohol enables man to undertake a larger amount of physical work. I have repeatedly asked a

number of men engaged in physical labour, and from an overwhelming majority of intelligent labourers I have received the answer that they can do more and better work without than with alcohol. I have received a similar answer from great wrestlers, quite in accordance with Dr. Mehler's observations on this subject [78], and in my long continued intercourse with Alpine climbers, the experience, with scarcely any exception, was, that alcohol did not increase, but impaired their power of climbing; and almost all my companions in the Alps, including my guides, gave up the use of wine and stimulants altogether, excepting in the smallest quantities, and this only after the day's work was done. I have stated above the quantity which may be considered as moderate, and which has a beneficial action on some old people in certain morbid affections, for instance, chronic bronchitis, as Dr. Savill [115] found in the aged inmates of a workhouse infirmary. Here, again, habit is to be consulted, and the personal factor is to be considered, and old persons accustomed for many years to a certain amount of alcohol ought not to be deprived of it all at once, but only by degrees. For a careful consideration of the question of alcohol I refer to the chapter

on stimulants in Sir Lauder Brunton's volume on "Disorders of Assimilation," &c. [16].

It is well known that alcohol exercises on some persons a much more injurious action than on others. It is frequently the cause of epilepsy, and it greatly aggravates the disease when it already exists; it ought to be entirely abstained from by persons affected with, or hereditarily disposed to this disease. The same is the case with dipsomania, which is in many cases of epileptic nature. The connection of alcohol with neurasthenia is more complicated; in the majority of cases of neurasthenia in which I have observed it combined with abuse of alcohol, other injurious influences were present besides alcohol, especially excessive smoking, continued mental worry and mental over-exertion, particularly when of an unsuccessful nature. Persons under the influence of worry, or unsuccessful work, often endeavour to remove their depression by alcoholic stimulants, which for the moment drown the sense of trouble and have an exhilarating effect, but are mostly followed next day by greater depression, the feeling of hopelessness, and diminished power of working. Stimulants ought never to be resorted to under such circumstances; change

of place and temporary cessation or change of work, if they are possible, and especially open-air games and other open-air exercise, are infinitely more promising, while alcohol ought to be entirely, or almost entirely, avoided.

Persons with small amounts of albumin in the urine, combined with signs of arterio-sclerosis, can mostly by great restriction in alcohol and meat prolong their lives considerably. I have had under my observation many such persons for ten and twenty years and more who enjoyed almost perfect health while they lived on milk and milk products, vegetables, bread, light puddings and fruit, with entire abstinence from alcohol. The majority of them, however, are disinclined to do so, and are inclined to misinterpret the advice of their doctors, if not given precisely, in favour of their own inclinations. It has repeatedly occurred to me, that when I told such persons that great restriction was necessary, they answered that Doctor X. considered such restriction quite unnecessary, that he said they were perfectly safe with only "a few glasses" of wine at lunch and dinner, and a moderate quantity of meat. They felt perfect security after this advice, and took their "few glasses," and died within two

or three years, while they might have lived and worked much longer with abstinence from alcohol and great restriction in meat food. Such feeling of "security" always reminds me of the words of Hecate in "Macbeth," which are so often applicable in life :—

> "And you all know, security
> Is mortal's chiefest enemy"—
> *Macbeth*, Act. iii. Sc. 5.

Sir Isambard Owen has given a careful analysis of the results of the Collective Investigation Returns, comprising 4,284 persons, and shows that the average duration of life was greatest in the total abstainers and very moderate drinkers, and that only few hard drinkers were amongst the long-lived (*British Medical Journal*, June 23, 1888, p. 1312).

Before leaving the subject of alcohol, it may be useful again to allude to the erroneous idea entertained by many persons when giving up the use of alcohol, that they may eat as much as they like, and may drink at meals as much common water or "table waters" as they desire. This misconception is, as I have already said, fraught with great danger, leading, as it does, in many cases to obesity, in others to weakness of the heart, to degeneration of the blood-vessels

(arterio-sclerosis), to dropsy, to gout, and in all to premature death ; the effect is much more injurious than even the limited use of alcohol at otherwise moderate meals.

IX.—Tea, Coffee, Cocoa.

The principal constituents of the *tea* leaves are caffeine, tannic acid, albumin, cellulose and some volatile oil. *Tea* is regarded by the majority of people as an agreeable and useful stimulant. It is not followed by a depressing effect, as alcohol is, and when taken in moderate quantity and strength it exercises a pleasant effect on the nervous system, especially in physical or mental fatigue, and is not injurious to the majority of persons ; but in some, particularly amongst those affected with dyspepsia and heart weakness, it produces development of gas and through this distension of the stomach and disturbance of the heart and the nervous system. The habit, which exists especially amongst some of the poorer classes, to take three to five meals of strong tea and this generally not infused but boiled, with inadequate food, is no doubt injurious ; it causes deterioration of the digestive organs, imperfect nutrition of the

heart, degeneration of the small blood-vessels, and malnutrition of the whole body ; it lowers the nervous system and produces occasionally even trembling of the hands and arms. The change which many people, especially amongst the labouring classes, have made since the middle of last century, in substituting tea and bread or potatoes for porridge, milk and cheese has exercised injurious effects, and must be strongly condemned. I have repeatedly seen alarming symptoms in the functions of the nervous system and the heart amongst children, produced entirely by the regular use of strong tea, symptoms which disappeared in the course of a few weeks after the removal of strong tea from the diet list, in favour of milk foods. The slow and insidious action of tea renders the abuse more common by making people think that it agrees with them. The fact that tea, especially strong tea, retards digestion, renders the habit of taking it as part of the principal meals (*high teas*) to some people rather injurious. When, however, great authorities condemn tea entirely as a poison, even when moderately used, and class it together with the eating of large quantities of meat or the immoderate consumption of alcoholic stimulants as a most potent

producer of gout and diseases of the heart and blood-vessels, and of the nervous system, we are not prepared to accept their view. It is true that the tea-leaves contain a certain amount of purin (methyl-purin), but if the quantity of tea consumed during twenty-four hours does not exceed the infusion of 40 to 80 grains, it cannot be regarded as a serious danger, barring a small number of exceptional persons. We have not seen much real gout amongst great tea drinkers if they were at the same time moderate with regard to meat and alcohol. Black teas agree with most persons better than green teas (China and Japan) which contain more tannic acid; and good qualities of Chinese teas which contain less tannic acid and have a finer flavour, better than Indian and Ceylon teas in the same quantity; but if the latter are taken in smaller quantities than the former, or mixed with them in the proportion of one part of Indian to two of Chinese, no objection ought to be raised against them. Tea ought not to be boiled but infused with rather soft only just boiling water, and the infusion ought not to stand longer than two to four or five minutes. Many persons who cannot bear an ordinary infusion of tea on account of the tannic acid, are enabled to do so

by adding a small pinch (2 or 3 grains) of carbonate of soda to a teaspoonful of tea leaves in the teapot. A teaspoonful (about 60 grains) of tea leaves ought to be quite sufficient for a breakfast cupful (about 8 ounces) of tea, and half the strength is better for most persons. Although some great tea drinkers object to the addition of milk and cream, most people bear it better with than without. The habit of taking a cup of tea an hour and a half to two hours before breakfast is beneficial to persons who rise early and do some work before breakfast, but the tea ought to be weak and mixed with milk. Taken in this way it sustains mental activity, assists defæcation, and aids the removal of waste products ; but a tumblerful of hot water is to many quite as beneficial. Those who condemn tea do not seem to consider that many persons who take tea as a stimulant save themselves through this from the abuse of alcoholic stimulants, which is infinitely more injurious than tea drinking. Finally, we must not forget that the abuse of alcohol often deranges the moral condition of the mind and is the most frequent cause of crime, which no one can say of tea drinking, by which at all events, even if taken injudiciously, only the tea drinker

himself is injured and not his innocent family.

Coffee contains, in addition to caffein, which has the same properties as thein, a volatile oil developed by the process of roasting, some tannic acid and cellulose and extractive material (Parkes [102], Koenig [68] and Hutchison [62]). The infusion acts on most people in the same way as tea, but in some cases it causes palpitation of the heart, indigestion and tendency to piles when they take it habitually, while they can take tea without harm. Many, on the other hand, of those in whom tea produces flatulence and faintness, bear coffee quite well. Coffee likewise has an inhibitory effect on stomach digestion, and strong black coffee after meals ought therefore to be avoided by dyspeptics with slow digestion. Parkes had a high opinion of the value of coffee for soldiers undergoing fatigue, and in severe Alpine climbing I have found coffee, on others as well as myself, rather more effective than tea, although the latter is likewise very useful. This effect is due principally to the *caffein* and partly to the *volatile oil* which both stimulate the brain as well as the heart. The relief of fatigue and exhaustion which is produced by coffee and tea

is, however, due, to some degree at all events, to the vehicle in which they are taken, viz., water, with or without milk ; for caffein taken alone in doses of several grains by my companions and myself in long mountain tours had never as strong an effect on us as a cup of tea or coffee, especially when taken hot. The fact that hot water alone under such circumstances removes much of the sense of fatigue, shows that the fluid has a great share in the action of one or two cups of tea or coffee. It is the fluid part which has the greatest share in clearing the tissues from the *waste* products, and this is a matter of the greatest importance. *Chicory*, which is often mixed with coffee, contains scarcely any tannic acid, no caffein and volatile oil, but a fair amount of sugar. It is decidedly less stimulant and is justly regarded as an adulteration, but it is not injurious to health, and is liked by some persons.

The various *imitation coffees* made from roasted cereals, acorns, carrots, &c., instead of the coffee bean, are wholesome but have not the taste of real coffee, nor the stimulating effect to those undergoing mental or physical exercise.

Kola had more effect on us than caffein alone, but not so much as hot coffee or tea.

This property, however, of enabling persons to bear extra fatigue, which tea shares with coffee, leads occasionally into danger. We have repeatedly observed that under their influence not only physical, but also, and perhaps more frequently, mental over-exertion was persisted in for weeks and months, until it led to exhaustion of the nervous system, which sometimes lasted through life. Working for scholarships, for instance, and for competitive examinations, has in this way caused some sad failures in life.

To the use of coffee similar objections are being made as to that of tea. Here, again, safety lies in moderation. The habit of German ladies of taking much coffee in the afternoon has often been mentioned as a cause of many of their troubles, but probably the rich and sweet cakes taken with the coffee, have something to answer for, and also the sitting over tea and coffee for hours which ought to be devoted to open-air exercises.

Cocoa is different in composition and action from either tea or coffee, although theobromin is chemically almost identical with thein and caffein. It is decidedly less stimulant. The beans contain a large proportion of fat, in addition to theobromin, starch, albuminous matter,

cellulose, some astringent and mineral matter. The cocoa prepared from cocoa nibs and shells is better borne by most persons than that prepared from the finely powdered kernel, which disagrees with some on account of the large amount of fat. The ordinary *chocolate* is mostly mixed with starch and sugar, which latter is a disadvantage to some dyspeptics. Cocoa and especially chocolate are much more articles of food than tea and coffee, and have great sustaining power in fatiguing climbs and other exertions, but are inferior to coffee and tea in stimulating power. To many persons the use of cocoa is preferable to that of strong tea and coffee, especially if prepared from cocoa nibs. If cocoa is taken with much milk, it becomes a real meal. An instructive chapter on tea, coffee and cocoa is contributed to the "Book of Health," by Sir Lauder Brunton, whose views are also given in his "Disorders of Assimilation and Digestion" [16].

We are often asked whether to give the preference to tea or coffee or cocoa in daily use. It is as impossible to give a general answer, as it is with ordinary articles of food. The personal element must mostly guide us. Where tea produces flatulence, and disorders of the

action of the heart, or trembling, or sleeplessness, it must either be greatly restricted or avoided entirely, especially after midday, and coffee or cocoa or milk may be substituted, whichever agrees best. Many persons bear all three equally well, and can suit their taste or convenience. The rule of moderation applies to these food accessories as much as to the ordinary articles of food. There are some persons who cannot take either coffee, tea or cocoa, and must be satisfied at breakfast with milk or porridge or similar dishes or water. Neither of the three is necessary for life.

X.—Tobacco.

Tobacco is to many persons a means of enjoyment and is well borne by them if they take it with great moderation; it soothes nervous irritability, and often makes men look more contentedly on their work and troubles. Some persons have an unlimited tolerance of tobacco, and seem not to be injured by immoderate smoking. On the other hand, excessive smoking is decidedly injurious to the majority of people by affecting the heart, the small blood-vessels, the digestion, the throat, the nervous system and the sight. In many cases diminution

of the amount of smoking, or taking a milder kind of tobacco, remedies the bad effects; in some, however, the use of tobacco has to be given up entirely. Boys and girls, before they are grown up, ought not to be permitted to smoke, as it prevents perfect development. There are good observers, amongst them Professor Lazarus, of Berlin, who regard excessive smoking as one of the principal causes of arterio-sclerosis, and when we consider the effect of tobacco on the heart in some people, it appears natural that the smaller blood-vessels are likewise injuriously influenced by it. Sir Lauder Brunton states that Boveri and Rickett produced atheroma in animals by intravascular injections of nicotine. In this connection we may refer also to a paper by Dr. Michels and Dr. Parkes Weber "On Arteritis Obliterans." The patients were Russian and Roumanian Jews, between 30 and 40 years of age, who were free from other morbid complications, but had in common: (1) that they smoked every day many cigarettes; (2) that their food was poor in quality, and probably insufficient in quantity; and (3) that they consumed a large quantity of strong tea. It is to the immoderate smoking that I am inclined to attribute the

disease of the arteries, and I may add that tea can probably be excluded, as Professor Israel, of Berlin, has communicated other cases of this disease occurring in Eastern Jews in the prime of life, who lived in Eastern Europe, where tea-drinking is not the custom amongst the poorer classes.

Snuff is out of fashion at present ; but to some people suffering from chronic catarrh of the nose, with insufficient secretion of mucus, a pinch, taken once or twice a day, is useful by increasing the discharge and rendering the breathing through the nose more easy, and also by maintaining to a certain degree the sense of smell up to old age ; it seems to act by its stimulation as a species of gymnastics on the capillaries of the Schneiderian membrane. Many old doctors maintained that snuff-taking was a good practice against some forms of frontal headache and blear-eyes, and I think with good reason.

XI.—Action of the Bowels.

An important matter with regard to the digestive system and the health of the whole organism is the *action of the bowels*. There are great differences in this respect with different

persons; many only feel well if they have one or two evacuations daily, and even more, and they mostly have them without being obliged to pay any attention to the nature of their food; others have a motion only every second and even third or fourth day. Although some of those who have an action only every three or four days, or still more rarely, seem to be perfectly well, the health of the majority of them suffers in course of time, especially by interference with the portal circulation and its consequences, and by the absorption of ptomaines, leading to headaches, drowsiness, lassitude, unfitness for mental work, some forms of neurasthenia and anæmia. *Constipation* is a frequent cause of colitis, and it may also give rise to more serious organic disease of the intestines; the irritation which the hard fæcal matters exercise on the mucous membrane of the colon and rectum, is, in some persons, one of the probable causes of cancer. It is, therefore, to be specially avoided in old persons, since in them the tendency to malignant disease is greater than in youth. A great point is to accustom the bowels to a regular action at a certain time of the day, a habit which ought to be cultivated from childhood; the morning, if possible, excepting in persons affected with

piles, to whom the evacuation of the bowels at bedtime is more useful, since by rest in the recumbent position after the motion the hæmorrhoidal vessels become relieved. An attempt ought to be made to obtain an evacuation at a fixed hour, even if no desire is felt. The quantity and quality of food are of great importance. A diet consisting principally of flesh food, eggs, cheese and farinaceous matter, is in many persons attended with constipation, while the diminution of these substances and the substitution of fruit and green vegetables, lead to regularity of the bowels and improved health. The principal reason is that of flesh food, cheese and eggs, the greatest part is absorbed in the upper portion of the intestines, and only a small quantity remains for the formation of fæces, insufficient to stimulate the peristaltic action of the bowel ; while green vegetables and fruit having a large proportion of cellulose, which usually is not absorbed in the intestines, yield a larger quantity of fæcal matter, sufficient to promote peristaltic action and regular evacuations. With many people, however, this change of diet alone is insufficient to make the bowels act regularly. They require, in addition to green vegetables, substances which

cause a greater amount of local mechanical stimulation, such as is produced by the bran of brown or whole-meal bread and biscuits. Sir Lauder Brunton explained this in a practical lecture on constipation some years ago. It is possible that part of the aperient effect of whole meal or wheaten bread and biscuit is due to the cathartic effects of wheat oil contained in the outer layers of the wheat kernel (H. Snyder) [121]. The best qualities of Smyrna figs are likewise useful, partly no doubt due to the seeds, but partly also to the other portion of the fruit. The addition of honey to breakfast promotes in many cases regularity of the bowels, but it disagrees with some persons. One or two fair-sized raw apples at breakfast or some uncooked French plums are of great assistance to many persons, while others prefer them at bedtime. Cooked fruit is less active, although it is likewise useful ; a disadvantage in cooked fruit and compots is the customary addition of much sugar, which ought to be avoided in those to whom sugar is hurtful (p. 87). Habitual constipation is usually ascribed to want of tone, or a torpid condition of the muscular coats of the intestines, but this is not the only cause in all constipated persons ; in many of them the

mucous membrane seems to be at fault either by insufficient secretion (Dr. Rolleston) or by over-active absorption.

Professor Schmidt [118] and Dr. Neville Wood [145] have explained the occurrence of constipation in many persons by the peculiarity of their digesting a great part of the cellulose contained in the food, and thus leaving a too scanty amount for defæcation. To prevent this they recommend such persons suffering from constipation to take once or twice a day a substance which is not absorbable by the intestines, and forms a coating round the food on its passage through the bowels, thus preventing the absorption of the cellulose and rendering at the same time the fæcal matter softer. Such substances are fluid paraffin and agar-agar. They are harmless and mostly efficient if the quantity is well adapted.

There are many people who think that it is better to take only the nourishing parts of food, which are in their opinion more digestible, and save their digestive organs the labour of extracting them ; they prefer meat extracts to meat, fruit jellies to the whole fruit, the finest flour to the entire wheat meal ; but this is a great mistake, not only on account of the

reason previously given, viz., the stimulation caused by the vegetable fibres, and other solid parts contained in the coarse meal and bran, but also because the stomach and intestines ought to be kept at work like all other organs of the body, provided they are free from ulceration, catarrhal affection, or other disease. Furthermore, the entire natural substances are more useful than the extracts ; although some meat extracts are useful the entire meat is more nourishing than ordinary extracts of meat, which do not make muscle, albeit they exercise some influence on the metabolism ; the very fine white bread is for the majority of ordinary healthy people inferior to the wheaten bread made from the entire flour, the whole-meal bread and any good household bread.

In some persons the insufficient intake of fluid is the cause of constipation, which is often removed by taking more fluid either at meals or, in the case of corpulency, away from meals. Another and frequent cause of constipation is inadequate physical exercise. It is for this reason that constipation is more common amongst sedentary women. Many persons become regular by increasing their daily walking exercise from half a mile or a mile to five

or six miles or more, or by long rides on horseback, or by active games such as golfing, football, and cricket, and the most beneficent influence is obtained from breathing exercises and their action on the abdominal organs (pp. 53 ff.).

Another help, and a very useful one, is the methodic contraction of the muscles of the abdominal wall, the *abdominal pressure* (*Bauch Presse* of the Germans). By slowly and thoroughly contracting the abdominal muscles from above downward fifty or sixty times or oftener, and by keeping them in contraction during full and prolonged expiration, the abdominal muscles themselves are strengthened and the liver, the bowels, the blood-vessels, and all the organs within the abdominal cavity are compressed, the entire abdominal circulation is activated, the blood squeezed out of the veins and more blood is sent to the heart, which is strengthened by the extra work which it has to perform. The strength of the abdominal muscles thus improved is also important for keeping the organs in the abdominal cavity in their proper position. The methodic contractions of the abdominal muscles and the abdominal pressure act in a somewhat similar way as ordinary *massage* by

the hands, which is very helpful and preferable to the daily use of purgatives.

A glass of hot or cold water, or of some aerated table water like Seltzer or Apollinaris or Giesshübler, or a cup of weak tea taken about one or two hours before breakfast has, in many persons, the desired effect. Many smokers find advantage from a cigar before breakfast. A wet bandage round the stomach and loins, worn during the night, is likewise often a successful measure. If by all these aids the regular action of the bowels cannot be obtained, and if the health of the individual suffers in consequence, mild aperients become to some persons a necessity, especially to gouty people. Many persons, however, always take aperients without requiring them, and live in constant fear of constipation—a kind of hypochondriasis. The use of the fluid paraffin mentioned above is to most persons preferable to ordinary aperients.

XII.—The Nervous System.

Equally important with the organs of circulation and digestion is *the nervous system*, which, we may say, governs all the other systems. We must therefore prevent its degeneration as

long as possible ; we must nourish it and keep it in action. The state of the blood-vessels and the circulation are again all important. Degeneration of the small blood-vessels of the brain, which causes impairment of the brain structure and functions consequent on it, forms a frequent cause of premature decay and death. The tendency to this degeneration, at a comparatively early period, is in many families hereditary ; but this hereditary premature decay is to a great degree preventible by moderation in food and stimulants, by regular physical exercise, and by judiciously arranged mental work and occupation. I have often witnessed this, and in a very striking way, in a family whose male members had for several generations all died between 56 and 64 from apoplexy, or paralysis, or other early decay of the brain functions. Of five brothers in this family who came under my observation when between 25 and 40 years of age, two carried out the advice to lead an active life, mentally and physically, coupled with moderation in everything, and lived to 70 and 73 years, and died not from degeneration of the brain-vessels, but from heart affection and pneumonia ; while the three others, with less active and less temperate habits, and too great

indulgence in sleep, died between 60 and 64 from apoplexy and paralysis. I could adduce many similar experiences in other families.

The Brain.

The *brain* profits like all the other organs of the body by physical exercise, in so far as through the increased action of the heart produced by exercise more blood is carried to it, and the arterioles and capillaries as well as the nerve-cells are kept in a healthy condition. Exercise, however, produces another and more immediate influence on the nutrition of the brain. As every voluntary movement is due to an impulse from certain portions of the brain, this impulse causes an increased afflux of blood to that portion through which the nerve-cells as well as the small blood-vessels themselves are nourished and kept in working condition, counteracting premature decay. The brain often decays from want of physical exercise or mental work, and this is especially the case towards the evening of life. We have frequent opportunities of witnessing this. Many men retire rather too early from business; others, especially officers in the navy or army and civil servants, are

obliged to do so by the regulations. Amongst these men we see not rarely weariness, dejection, and an inclination to give up all occupation and active habits, to sleep often by day, to remain longer in bed, to smoke immoderately and sit longer over their meals; in consequence sickness of different kinds is developed and not rarely premature decay of the brain functions. Such men ought to find occupation for their brains, and take regular bodily exercise. They ought to seek some objects of interest in art or in literature, in history, geography, geology, zoology, botany, in studying the habits of insects or other animals, in gardening or agriculture, or in travelling, or in adopting and educating a child, and in other philanthropic matters, &c.; they ought to cultivate a hobby, for instance, in collecting prints, autographs, antiquities, or coins, by which they are induced to study art, history, antiquity and mythology; even the collecting of postage stamps, in default of something else, can be used as a source of mental occupation. The cultivation of such a hobby ought to be commenced while people are still at active work, since the inclination and the aptitude to begin something new disappears not rarely long before 60 or 65, when they have to retire from their

work. Many old people derive great benefit from chess and other intellectual games, also from games at cards or dominoes, especially when the eyesight for reading fails, provided over-excitement or passion is avoided. The families or companions or nurses of old people ought therefore to play with them, or otherwise occupy them, instead of allowing them to go to sleep for several hours during the day or the long evenings. Amongst the classes of people who die earlier than they ought to do from imperfect brain work, are some who had lived a healthy life up to 50 and 60, but then began to fail from want of occupation or activity. I have observed this, for instance, amongst farmers, who, when they felt less inclination to take the long walks and rides necessary to superintend their farms, allowed their work to be done by their sons, indulged, however, in the comparatively large amount of food to which they had been accustomed, spent the greater part of the day during the long winters indoors, became stiff in their limbs, sleepy and indolent, and died between 66 and 72. This may be called a respectable age, but it is not the age which they would probably have attained, if they had sufficiently occupied their minds, diminished

the amount of food, and kept up out-of-door life and exercise. Similar observations I have made amongst well-to-do tradesmen and other classes, to which I have already alluded. A great point is to keep up *variety in mental occupations*, and to keep awake the interest in many things so as to prevent mental torpor.

Another advantage of regular, even absorbing occupation is that it prevents us from turning our attention to our own feelings and failings, to our mental and physical troubles. Many persons are apt to pay too much attention to slight ailments, and imagine them to be the beginning of serious disease and suffering, become through this mentally depressed and unhappy, and at last imagine that they are the subjects of serious incurable disease. These *imaginations* often give rise to real disease of mind or body. The most effective remedy, preventive as well as curative, of such morbid imaginings and their grave effects, is constant occupation combined with open-air exercise. Great moderation in eating and drinking must be added; many forms of mental depression and morbid imaginings depend on dyspeptic conditions. All mental occupation leads to increase of flow of blood to the brain, activity of the small blood-

vessels and nutrition of the nerve-cells. I have already mentioned Mosso's experiment [86]. I could produce the most remarkable proofs of the influence of mental activity on the condition of the heart, the digestion and the whole body. I cannot resist mentioning a very striking case which I had the opportunity of watching from day to day, as the subject was an intimate friend of mine. A man of great energy and intelligence, who was the leading spirit in a well-known hospital, began to get languid and to lose his interest in his work at the age of 76. The action of his heart gradually became weak and very irregular, he lost the expression of intelligence peculiar to him, the saliva ran constantly from his mouth, and a viscid and acrid fluid from his swollen eyelids ; the action of the bowels and the bladder became extremely sluggish ; œdema of the legs, and at last effusion into the pleural cavities, developed themselves in his eighty-second year, when suddenly the arrangements which he had created and for which he had incessantly worked at the hospital were in danger of being overturned. This caused violent excitement in him ; he began at first to dictate and soon to write letters, he held meetings, and succeeded

in saving his arrangements and his influence. Marvellous was the improvement manifesting itself from day to day while this work was going on. The pleural effusion and œdema disappeared, the heart became almost regular, the eyes and mouth returned to their natural conditions, the puffiness of the face subsided, and the intelligent expression came back. He remained in this improved condition over a year, when he died of pneumonia, supervening influenza. It was the work of the brain and the joy at his success which caused this astonishing improvement. Wonderful is the effect of *ucces* , and equally so that of *joy;* it shows the immense power of the mental condition over the whole organism. The opposite conditions of the mind, such as *grief* and *loss of hope*, cause in some people the greatest mental and physical depression, total indifference for their surroundings, combined with at first functional, afterwards organic changes, especially dilatation of the heart, and death from what may truly be called a "*broken heart.*" Diminished respiration, weakening of the action of the heart, and imperfect supply of blood to the brain, probably have a great share in these conditions of depression. Sometimes, as in the

man just described, but not always, we are able to produce a favourable turning in such cases by awakening an interest in near relatives or friends, or by some other powerful mental influence, which is followed by arousing the depressed functions of the brain, the heart, and the rest of the body. Of many cases of this kind which have occurred to me, I will narrate only one: A lady, 70 years of age, lost suddenly from acute disease her husband, a very distinguished physician, whom she had adored, and with whom she had shared every pleasure and every sorrow throughout their long and happy union. She was highly cultivated, very active, and took a lively interest in all her surroundings. Immediately after the unexpected death of her husband she became mentally depressed and perfectly helpless, while formerly she had been full of resources. The condition might be called "*mental paralysis*," or acute melancholia. It was almost impossible to induce her to take food, she nearly always sat in a corner of the room with her head bent down, frequently sighing, and took scarcely any notice of the members of her family, of whom she had always been very fond. Within less than three weeks the heart, which had been quite sound,

had become dilated, the pulse had become weak and irregular, and a loud systolic mitral bruit had developed at the apex. The legs had become œdematous. The intellectual and sympathetic physiognomy had turned into an expression of apathy and stupor. This state continued and increased for some weeks; she became greatly emaciated and was expected shortly to die, when as a last experiment an urgent message was sent to her from a daughter who had not been able to leave her bed for several years, and had entirely depended on her. The daughter implored her to see her once more before she died; the mother was carried to her, and her maternal interest and affection were aroused by the daughter's helplessness and grief and attachment. She took some food and stimulant while with her, revived from that moment, and was daily carried to this invalid daughter, whose joy at her mother's arrival seemed to act as a powerful stimulus on the latter, who gradually regained also her interest in other members of the family. The aged lady recovered her general health in the course of three months, although the heart remained somewhat dilated and irregular; she became again the centre and soul of her large family,

and retained her faculties until her death, in her eighty-sixth year.

Equally injurious as grief and sorrow is *worry*, by which the equanimity is destroyed, and the joyful performance of the daily work and duty is rendered impossible. Worry is doubly injurious if caused by one's own faults, either of commission or of omission. The habit of some persons to make worries is most injurious, and ought to be counteracted from an early period by all possible means.

It may not be quite easy to explain the physical mode of action of happiness and allied mental conditions on the one side, and dejection and unhappiness on the other, but if we consider the immediate effects which in most persons emotions produce in the action of the heart and blood-vessels, including the capillaries, it becomes more intelligible. The palpitation of the heart and the flushing of the face under the influence of joy or shame, the paleness and feeling of coldness and shivering from fear, grief and anguish, clearly show the intimate connection between mind and heart, which is so constant that both words are, in common language, often used in the same sense. Both happiness and unhappiness act on the heart and circulation,

and the vaso-motor system, the former stimulating, the latter depressing, but the mind is no doubt first influenced, and through it the respiration and the entire circulation from the heart to the smallest blood-vessels. On watching persons under despondency and grief, I have often found their breathing superficial and irregular, interrupted occasionally by a sigh, and their pulse weaker, sometimes irregular and less frequent from imperfeet action of heart ; while under the influence of joyful news the breathing became regular and deeper, and the pulse fuller and regular, rising within half an hour or less from 50 to 70 and 75, its habitual rate of frequency. Evidently the centre of the pneumogastric nerve is influenced by these opposite forms of emotion. It is often impossible to remove sorrow, grief, mental anxiety, and depression by friendly encouragement, but we must endeavour under such circumstances to counteract these injurious agencies by physical means. Urgent work, if it can be procured, but all exercise, active or passive (in carriage or bath-chair), in the open air is one of the most powerful agencies, and rarely fails gradually to exert its beneficial influence.

There can be no doubt that *pleasure* is often

a source of *happiness*, but it is by no means identical with happiness, and the habit of hunting after pleasure is a frequent source of unhappiness, and not rarely also of illness. The seeking of pleasure must, therefore, be limited in a judicious manner, and pleasures which are lasting must be preferred to pleasures of an exciting, momentary, or transitory nature. A different matter from pleasure is *cheerfulness*, and in order to promote *cheerfulness* we must cultivate *contentedness* with the circumstances in which we are placed. "Gladness of heart is the life of man, and the joyfulness of a man prolongeth his days." It is, further, of great importance to educate the *sense of duty* with regard to one's position in life and to one's surroundings. A person who does his duty and, through this, is satisfied with himself, in other words, has a *good conscience*, is, other matters being satisfactory, happy ; and even if the circumstances are not to his liking, if he meets with losses and disappointment, he is able to keep his equanimity, to bear them well, and to make the best of the situation. On the other hand, a man who has reason to be dissatisfied with himself, or has a *bad conscience*, is unhappy, looks at the circumstances surrounding him in a mistrusting and

despondent manner, and is less able to extricate himself out of a difficulty; he often becomes depressed, his resisting power is lowered, and he is easily attacked by disease. The sense of duty ought, therefore, to be cultivated from an early age through life. The head of the family, for instance, who neglects the happiness of his wife and the training of his children for his personal enjoyment, and a wife who shirks her duty of bearing children and of nursing them for frivolous motives, fine clothes and social excitement, often prepare for themselves worry, disease and premature death. In not a few instances I have seen that parents who, in the earlier years of their married lives, had, for their own convenience, limited their progeny to one child, lost this only child after it had grown up. It had been the bond of union between them and the centre of their happiness. The death of this only child caused them the greatest unhappiness; in one case deep melancholy of the wife, in another estrangement between husband and wife for the remainder of their lives, in another suicide. Again and again Goethe's words came before my mind:—

"Denn alle Schuld raecht sich auf Erden."
("For vengeance follows on the guilty deed.")
Free translation.

Dereliction of duty is often revenged not by the law but by the conscience, and by unhappiness.

On the other hand, those who bring sacrifices for home and family, for the alleviation and improvement of the condition of the sick and helpless with whom they come in contact, earn *mental satisfaction* and *happiness*, which act like sunshine on the whole body, and thus become means of prolongation of life and of a happy old age. A further point of *self-education* connected with the sense of duty is the restraint of our *passions;* not only must we check our anger if anything displeases us, but we must also conquer undue ambition,[1] vanity, avarice, jealousy, illicit sexual desires, which often become, as you know, the cause of bodily and mental disease, premature death, or "miserable" old age. Bacon says: "Avoid envy, anxious fears, anger, fretting inwards, subtle and knotty inquisitions, joys and exhilarations in excess,

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[1] "Ambition" is not to be absolutely condemned; a certain amount of ambition is to many persons useful as a stimulant to learning and progress; it is almost needful to the soldier; but "undue ambition" often leads to injustice towards others and to crime.

> "I charge thee, fling away ambition;
> By that sin fell the angels."
>
> "*King Henry VIII*, Act iii."

sadness not communicated" [8]. Another part of self-education is the duty of combating *self-indulgence* with regard to excess in food, drink, sexual and other pleasures and to idleness. Self-indulgence leads to moral and physical weakness, want of resisting power to disease, and mental depression, *self-control* to increased mental and physical strength.

We must endeavour to promote *cheerfulness* by the arrangement of our whole manner of living, as far as lies in our power, without neglecting our duty. We must endeavour to cultivate the sense for beauty of Nature and art. Much can be done in this way, for instance, by flowers, by pictures and drawings, at home, in cottages, public schools, hospitals and sick rooms.

"A thing of beauty is a joy for ever."

Bacon recommended "studies that fill the mind with splendid and illustrious objects, as histories, fables, and contemplations of Nature." We must acquire the habit of *concentration* and *thoroughness* in our work, and must avoid too great multifariousness which leads to haste and hurry. Habits of *haste* and *hurry* prevent mental satisfaction, over-excite the heart, and gradually injure its nutrition and structure. While well-regulated work, adapted to the individual

powers, strengthens the brain and heart, ill-regulated or ambitious work, exceeding the mental power of the worker, deranges them, and often leads to premature breakdown. Sir William Osler says in his address to the Yale students in April, 1913, in his own graphic way : "One of the saddest of life's tragedies is the wreckage of the career of the young collegian by hurry, hustle, bustle and tension—the human machine driven day and night, as no sensible fellow would use his motor" [99].

We must cultivate *restfulness* and *equanimity*, and the habit of looking calmly on the events coming before us, of calming unnecessary fears.

A further powerful agent in creating and maintaining health of mind and body is *the will*. We must develop it from youth and cultivate it throughout life. An effective influence in this respect is exercised by our endeavouring to carry out in our daily life what we think good and right towards others and ourselves, in great as well as in small matters even under difficulties, and with sacrifice of pleasure. Our persevering in our daily walks, even in disagreeable weather, is one of the many instances in this direction, and the practice of moderation in sensual enjoyments is another. A strong will

is a powerful agent, preventive as well as curative with regard to neurasthenia and many forms of neuroses. Amongst a number of persons exposed to the same injurious influences, such as intense cold, draught, want of food, vitiated air, some by a strong will prevent disease, while others are overpowered by them. A large proportion of those whose lives I have been able to influence and prolong, exercised their strong will in carrying out the precepts which I gave them, although they appeared to them at first tedious and difficult. *I will not decay early*, they said, *I will maintain my powers and faculties* as long as possible. And not only is a strong will a great aid in attaining longevity by maintaining health and preventing disease, but it is also a powerful agent in overcoming disease. I have seen many, and amongst them some marvellous cases. A man, for instance, above 60, who had suffered for more than eighteen months from a weak and dilated heart, from cirrhosis of the liver, œdema of the legs, and ascites, and had been tapped seven times, was scarcely ever free from pain and from a sense of exhaustion; he was justly refused by a Life Assurance Society, and was told that his chances of recovery were doubtful. At first he was much

depressed by this pessimistic prognosis, but on the following day, after having thoroughly considered his position with me, he said that he must live on account of his large family, that he *would* not die and *would* do everything in his power to prevent death. He began to carry out all our rules, however difficult it was to him, with regard to food, open-air life, different kinds of exercise, and change of climate; he regained his health within two years and remained well up to a considerable age. Such occurrences, I know, may be regarded as coincidences only, and not as due to the will; but as I have observed many cases of a similar nature, I am convinced that the will of the patient has had a great share in the successful issue. The will is, indeed, a great power in disease as well as in other conditions of life.

These considerations of attributes of the mind bring me to the borders of *mental diseases*, which often, though not always, shorten life. In many cases there is a hereditary tendency, but this can mostly be counteracted successfully by promoting the general health, by strengthening the balance of the mind, by healthy occupation and exercise, by enlightened mental surroundings, by great moderation, by cultivating contentedness and

hopefulness, and by governing the passions, while at the same time all exciting causes, including ill-regulated or excessive mental work, must be kept off as far as possible. While I write this a very suggestive paper by Sir Samuel Wilks comes before me, "On the Correction of Hereditary Tendencies" (*Lancet*, October, 1903, p. 1151). He occupied himself with the hereditary tendency to vice, but his suggestions apply also to other forms of mental irregularities; he especially points out as means of cure, change of mental surroundings, from the houses of vicious parents or relatives to healthy surroundings or schools, where the qualities of self-respect, integrity, independence, and a just dealing with others are brought out. Lord Bacon, in his "Advancement of Learning," speaks of particular remedies "which learning doth minister to all the diseases of the mind."

Before leaving the mental condition and the influence of mental work, I must again express my conviction against the doctrine that under ordinary conditions work wears out the organs sooner than idleness or great restriction in work. It certainly is wrong with regard to healthy brains, if the work is well arranged and is not "overwork." Judiciously arranged mental

work in itself, with fair intervals of rest, does not wear out but strengthens the brain in the same way as the power of the heart and the blood-vessels and muscles is maintained and strengthened by adequate physical exercise. When Sir William Gowers [48], in a lecture, full of wisdom, on the nervous system in old age, speaks of the necessity of *rest* in old age, he cannot mean to prohibit regular mental occupation, but only "overwork." The mental faculties ought to be exercised during the greater part of the day and the whole year, holidays included, but there ought to be a change in the nature of the work, so that one sphere is in a comparative state of rest while the other is employed. Dr. James E. Pollock [107] says very well: "Sameness begets weariness, causes the mind to grow old and accelerates bodily decay." In the majority of people who exercise their mental faculties judiciously, these are retained longer in fair energy than the functions of the muscular and digestive systems. We find, at all events, statesmen, judges, orators, doing almost their best work after 50 and 60. We have fortunately many instances of great brain-workers attaining considerable ages and maintaining their faculties to the end, in science,

in arts, in politics, in the law and divinity, and also in medicine. Cicero says "the intellectual powers remain in the old, provided study and application are kept up, and old age need not be inactive, indolent and drowsy." We have striking instances in painters, in Giovanni Bellini, Michelangelo, in Titian, Franz Hals, and in Sidney Cooper; we have amongst other brain-workers, Sophocles, who is said to have written tragedies at 90 and more, Plato, who, in his 81st year, died while writing; Isocrates, who wrote the "Panathenaicos" in his 94th year, and lived five years after; Galen; Cato (Censorious); Cicero; Sir Isaac Newton; John Wesley; Heberden; John Howard; Benjamin Franklin; Goethe; A von Humbold; Chevreuil; Victor Hugo; Kant; Voltaire; Sir Henry Holland, the physician; Sir Moses Montefiore, the philanthropist; William I. of Germany; Moltke; Bismarck; Dr. Holyoke, an American physician (died at the age of 100); Manzoni; Leopold von Ranke; Mommsen; Gladstone; Lord Masham, the great inventor in modern industries; Mrs. Elizabeth Hanbury; Mrs. Neave, of Guernsey; Madame Viardot, the celebrated singer; Lord Wemyss; Lord Strathcona; Sir Charles Tupper, the Canadian Prime

Minister ; Sir Henry Pitman, the Emeritus Registrar of our own College, who lived to above 100 ; Sir Francis Galton, the great worker in anthropometrics, heredity and eugenics ; Tolstoi ; Miss Joanna Hastings, sister of Sir Charles Hastings, the founder of the British Medical Association ; Manuel Garcia, the inventor of the laryngoscope, who celebrated his 100th birthday in the early part of 1905 ; Sir W. Huggins, the astronomer ; Baron de Waldeck, who died in Paris in 1875, aged 109 ; Elise Averdieck, of Hamburg, who died in her 100th year, after a most active and useful life as a teacher and deaconess ; and many others who contributed through their work to the pleasure and benefit of others and to their own happiness and longevity. We have, on the other hand, good reason to assume that neglect of the mental faculties, idleness, excessive amount of sleep, lead to premature decay of the brain functions and to shortening of life. Few people only die of mental overwork, compared to the large number of those who shorten their lives by over-rest. There are, we all know, cases of real over-exertion of the mental faculties, but these are comparatively rare ; and amongst them are many of misdirected brain-work, of persons

who undertook tasks which were beyond their powers, or duties in too many fields. I have also met with a number of persons who were said to have injured themselves by "mental overwork," but when I inquired more carefully into the circumstances, I found that in addition to their work they had indulged in too large meals, in whisky and other sensual enjoyments, or they had worked under the influence of worry, or had not interspersed the hours of work with hours of rest and recreation, or refreshing conversation, or had neglected physical exercise.

We need not conceal from ourselves that we do not retain in old age the same rapidity and force of thought, and the same memory which we enjoyed in youth and manhood; but we must not allow ourselves to become depressed by this or to give up mental work. We must endeavour to retain our mental equanimity and do as much useful work as we can by which that feeling of contentedness is produced which exercises the most beneficial influence on the whole organism. Nothing is more injurious to old persons than the idea that they are useless, that they cannot any more do anything either for themselves or for others, that they are only burdens to their friends, and that they

must die soon. I have often seen people of advanced age rapidly decaying, when through some unhappy influence they allowed themselves to be seized by such ideas ; but I have also had repeatedly the happiness to see such despairing persons recover strength and activity and happiness, when we succeeded in reawakening self-confidence and hope. This fact cannot be strongly enough impressed on the aged themselves and on the friends surrounding them. *Pessimism* is always to be condemned ; it is depressing and prevents our making the best of our position. It is under circumstances quite right to acquire a full insight into the dangers and disadvantages of our condition, but we must at the same time diligently search for the means to remove or at all events to mitigate them. We are not in favour of blind optimism, but of realism, and this realism not rarely leads to victory.

Many people have been startled by a statement in Sir William Osler's Valedictory Address at Johns Hopkins University [98] about the comparative uselessness of men above 60, and that all the effective and vitalizing work of the world is done between 25 and 40. His partly jocose remarks seem to have been

misinterpreted. I understand Professor Osler's remarks much in the same way as Sir Samuel Wilks does in his philosophical article "De Senectute" [144]. He thinks that the principal activity, we may call it the creative period, ceases in the middle of life, viz., about 50, that, however, judgment and ability to do useful work may last to much more advanced life. To use the words of Sir Samuel Wilks: Men (older than 50) "may still continue to take their appropriate share in the affairs of life. The work which they then do need not be original and new, implying a retention of the same mental activity as they had previously possessed, but rather the turning to account the knowledge which they had previously gained, and so utilizing their experiences for the benefit of others as did the Nestors of old" (*Lancet*, 1905, vol. ii, p. 1606). Sir William Osler is himself a striking instance that life long after 40 may be very useful, by his example, by his literary work, by the way in which he fulfils his manifold functions as Regius Professor of Physic at Oxford and member of several medical and scientific institutions, and by the influence he exercises on the young men entering their professional career. *Dryden* in his advanced

age boasted with perfect truth that his mental faculties were as vigorous as ever, when he says in his Preface to the Fables, "What judgment I had, increases rather than diminishes, and thoughts, such as they are, come crowding in so fast upon me that my only difficulty is to chuse or to reject, to run them into verse, or to give them the other harmony of prose."*

XIII.—Sleep.

In association with the nervous system we must pay some attention *to sleep*, that most wonderful function of our organism. It is well known that Arthur Durham, of Guy's Hospital, found by experiments on animals that in sleep there is a certain degree of anæmia of the brain; and it is now generally assumed that the circulation in the small blood-vessels of the brain is intimately concerned with the function of sleep. Dr. G. Oliver points out that during sleep the arterial pressure falls, the venous rises, and that the tissues are irrigated with lymph, which leads to their restoration and nutrition. The amount of sleep required differs very much in different people and at

* The Works of John Dryden, edited by Walter Scott, Esq. Vol. xi, p. 209. London, 1808.

different ages, and even in the same persons at different times and under different circumstances. Children and young persons at school require much more than adults. Sleep promotes with them nutrition and growth ; it is to them the "great nourisher in life's feast." Most adults do not require more than five and a half to seven hours, but some take nine hours and over. Much depends on the nature of occupation and on habit, and there are in this matter, too, good and bad habits. Sleeping too little for one or many months, say under five or six hours in children between 8 and 14 years of age, and under four hours in adults, causes in many persons impairment of digestion, sanguification and nutrition, emaciation, anæmia, mental irritability, neuralgia, and other troubles of the nervous system. This is easily understood when we take Oliver's experience just mentioned into consideration, for we learn from it that too little sleep gives not time enough for the process of nutrition of the tissues. Oliver's experience also shows why during active growth much more sleep is required than in the later stages of life, when the body is thoroughly developed, and why the curtailing of sleep in children and growing persons is so

much more injurious than in adult life. Dr. T. D. Acland has quite lately judiciously discussed this subject [1]. The habit of sleeping too little is, however, less frequent than that of sleeping too much. There are some hard brain-workers who never sleep more than five hours and even less, and enjoy good health with this small amount up to old age, if they live otherwise correctly. There are many persons who worry themselves if they sleep less than seven hours and if they wake several times during the night. They mostly do themselves more harm by worrying about the supposed too short hours of sleep, than by the small amount of sleep they get ; and if they can be persuaded that they are not injured by the shorter hours, that rest in bed by itself leads to restoration of the body, they mostly begin to sleep better. I have often experienced this in others and in myself. I have been a bad sleeper from an early period of my life, but especially after the age of 28, when for more than thirty years I rarely was in bed more than six hours, and awoke almost every night twenty times and mostly oftener. At first the idea that this must weaken my working power worried me and lengthened the waking intervals between the

spells of sleep ; but when I gradually found that my health did not suffer and that I could do my work in spite of imperfect sleep, the waking intervals became shorter. What, however, was most helpful to me, was the giving up writing professional letters after 10 p.m., and occupying myself for an hour or more with the study of Greek coins, Greek history, geography, and mythology. Similar occupation with a hobby in the late evening hours I have found also most useful to numerous other persons. Many, however, I could not persuade, but on waking early in the night they turned their thoughts to their occupations or worries, and as everything looks blacker during the night than in broad daylight, they dreaded this so much that they took alcoholic drinks or sleeping drugs either on going to bed or during the night as soon as they woke up. This is a very bad habit and ought never to be resorted to excepting under the well-considered advice of the doctor. The frequent use of anodynes and sleeping remedies (narcotics, hypnotics, soporiferous substances) weakens the heart, the nervous system, the digestion and the resisting power of the body. Among the means frequently used is a dose of alcohol (Cognac, whisky, rum) at

bedtime or on waking during the night. Although I am aware that a small quantity of alcohol, say a dessertspoonful or a tablespoonful of whisky or Cognac in a little milk or water, often produces sleep, it ought never to be allowed to become a habit, and its use ought to be restricted to rare exceptions, like that of chloral, opiates, and other somniferous medicines.

In all cases of so-called sleeplessness, it is necessary to inquire whether the amount of sleep obtained by persons is really insufficient, and if so, we must endeavour to find the cause and to remove it. The tendency to sleep badly can often be corrected by taking a slight meal on going to bed, or on waking during the night, such as a cup of milk or milk-gruel, a plain biscuit or some light farinaceous food. This leads to more blood being attracted by the stomach and the amount of blood in the brain being diminished, and it also acts on the mind. In some persons a late dinner or supper or an injudicious article of food, or coffee or tea at a late hour, is the cause of imperfect sleep ; in others, insufficient bodily exercise ; again, in others exciting mental work or correspondence or conversation at late hours. In every case one must endeavour to find

out the cause and try to remove it. In some people a warm bath at bedtime, in others a cold bath, and again in others a wet bandage round the stomach, improves sleep.

Many persons who awake too soon and cannot go to sleep again will do so if they get out of bed for a few minutes. Reading or being read to is likewise often useful. Not rarely I have found too great heat and closeness of the air of the bedroom the cause of bad sleep, and the cure in the open window. In persons with cold feet, a hot water bottle often proves an efficient remedy, again in others an extra woollen blanket brings sleep, and in hot weather the removal of the greater part of the bed clothes. Sir James Sawyer has treated the whole subject of "Insomnia" in an exhaustive manner, and has given excellent advice in his lectures on this subject [117].

Much sleep, viz., over eight hours—I speak here of adults—is mostly more injurious than too little, especially in persons of full habits, by causing diminution of nervous energy, or degeneration of the small arteries or capillaries of the brain, and in consequence apoplexy or premature decay of mental faculties. I have seen this in several of my best friends, amongst

them a justly celebrated physician. Immanuel Kant, who was not only a great philosopher but had also very judicious views about health and most matters of life, says that much sleep exhausts the energy and shortens life [66]. Sir John Sinclair [120], in his most diligently compiled work, says: "It is proper to add, that nothing is more pernicious than too much sleep. It brings on a sluggishness and dullness of all the animal functions, and materially tends to weaken the body. It blunts and destroys the senses, and renders both the body and the mind unfit for action. From the slowness of the circulation which it occasions, there necessarily follows great corpulency, a bloated habit of body, and a tendency to dropsy, lethargy, apoplexy, and other disorders."

The time for sleep is the night, and sleep during the day, which is so necessary for infants, ought not to be indulged in by healthy persons in middle life and only very moderately by old people, barring exceptions, as for instance after severe illness, or exhausting work. It is a bad habit to transform the night into day and the day into night, to do mental or social work after midnight and to sleep in the morning until

9 or 10 and later. With few exceptions the long-lived reported on and analysed by the "Collective Investigation Committee" (Humphry, "Old Age") rose early and went to bed early, and my own observation is entirely in accordance with this.

At the risk of being blamed by those who maintain that a certain number of hours of sleep, say six to eight, is absolutely necessary, and that it must be taken by day if it cannot be taken at night, I may say that I have always recommended men of work, physical or mental, to rise at the same early hour, even if they had gone to bed later than usual, or had not slept well. There are, I need not say, a few necessary exceptions to this rule, such as men in the House of Commons, if the sittings last till 2 or 3; or medical men who have spent the greater part of the night at the bedside of a patient; or delicate ladies who have been, owing to our bad habits, at dances till long after midnight, or workers on morning newspapers. It is at present in England the habit of most men occupied with literary work which cannot be done during the day to do it during the late evening hours and after midnight; they say that they cannot collect their thoughts and bring

them into proper shape in the morning, but can do so in the late hours of the evening, and better and better during the small hours of the morning. I acknowledge that it frequently is so, but I maintain that this is only the consequence of a bad habit, and that for those who accustom themselves to it, the morning work is the best, and that this is also more in accordance with the laws of health. Many people, it is true, cannot work well for several hours in the early morning with an empty stomach ; but by taking on rising a cup of milk, with a piece of bread, or of weak tea with milk, and a biscuit, they can do their mental work, or take early walks with great advantage. John Wesley, the well-known divine, it is stated, rose for sixty years every morning at 4 o'clock, and never slept more than six hours. I could give numerous instances of great mental workers who from an early period of life were in the habit of rising always between 5 and 6 o'clock, even if they had been obliged to remain up till after midnight once or twice a week, and who lived and retained their working power in spite of these short hours of sleep to the age of 75 to 85, and even longer. Several judges of my acquaintance, while on duty, rise at 4 or 5 and prepare themselves for their work ; and one

of them is now alive, though lately retired, and enjoys good health at 88.[1]

XIV.—The Skin.

An important organ, by which the general health and the duration of life are powerfully influenced, is the *skin*. It is the chief regulator of the body heat; it has a great share in the execretory functions of the body, and reflects the impressions from without on the different parts of the nervous system. In old age the skin becomes drier and less elastic, and many of the capillaries become obliterated. All active exercises help in keeping up the circulation in, and the functions of, the skin, but one of the most powerful means is the *bath*. Many persons with an active circulation can use cold baths from early life to very old age; others with poor reaction, especially weakly rheumatic subjects, do better with a hot bath; again, others begin best with a hot bath and then let in cold water and sluice themselves, head included, thoroughly with cold water, or take a cold

[1] This refers to Lord Brampton, who died in 1907, at the age of 90, after a very short illness, and was living when the above was written.

shower bath at the end. By exposing the skin and its blood-vessels to an alternation of heat and cold, we enable them to react more quickly to the changes of the external temperature and thus prevent chills. The hot bath has, in addition to its local effects, an immediate influence on the distribution of blood through the different parts of the body. The heat of the water attracts a large amount of blood to the skin, and diminishes the amount contained in the internal organs. It ought, therefore, not to be taken soon after a principal meal, when the stomach requires a larger amount of blood. The active rubbing and drying with a rough towel after the bath does not only dry and massage the skin, but obliges the bather to make many movements with the arms and the muscles of the trunk which he would not do otherwise. Thus the bath acts as a kind of gymnastics to the skin itself and induces also gymnastics of the arms. The bath, either cold from the beginning, or first hot and then cold, helps to preserve the elasticity of the blood-vessels of the skin, strengthens the heart, and also assists in maintaining the energy of the nervous system. The Japanese have a very high opinion of the usefulness of the daily bath ; every hamlet

in Japan has its public baths, hot and cold, the former generally preferred. The Hindu, Mr. S. M. Mitra informs me, is obliged by his religion to take a bath every morning before he takes any food.

With the ordinary bath we can conveniently combine a short *air bath* by keeping the body uncovered for several minutes after the drying and rubbing process has been finished, while the skin is in a state of turgor or glow. This exposure of the whole body to the action of the air increases the tonic influence of the bath. Various gymnastic exercises with the arms, legs, and trunk ought to be combined with this air bath after the water bath. The air bath alone during some minutes to half an hour and longer, if used with judgment, improves the condition of the skin, and through it the nervous system and the metabolism; it also diminishes the liability to "colds" and "rheumatism." Those who have time and opportunity can take a *sun bath* by exposing the naked or nearly naked body during five minutes to half an hour and longer to the active rays of the sun. The light of the sun, combined with the heat, exercises a more powerful influence than the hot air bath or ordinary air bath alone

on the general metabolism; it is especially beneficial in chronic rheumatic ailments. The cures with *electric light baths* and *hot sand baths* are based on similar principles. It is easily understood that the air bath alone without heat abstracts warmth from the body according to the external temperature and the degree of movement of the air, and that the duration of the air bath must be regulated according to these influences and the condition of the individual. This remark applies also to all other forms of baths.

A kind of local air bath is supplied by walking and driving whenever possible with the head uncovered. Many chills which are frequently caused by cold draughts on the head are through this avoided. Microbes are destroyed by the free exposure to light and air. The vigour of the scalp is maintained and the growth of the hair is promoted. The founder of the Bluecoat School deserves praise for the judicious law to keep the heads of the boys uncovered in all weathers.

If a full bath cannot be managed, a hip bath combined with sluicing the head thoroughly with cold water may be substituted; and if this, too, is impossible, the whole body ought to be

rubbed vigorously with a wet towel once or twice a day.

For good advice on the cultivation of the skin and hair I may refer to Sir Malcolm Morris in the "Book of Health" [85].

In connection with the skin we must say a few words about the *hair*, which is not a mere appendix or ornament, but also an organ of protection. The hair undergoes, with the advance of age, considerable changes, which are especially noticeable in the hair of the head, including the beard, and which Metchnikoff ascribes to the action of the makrophages. There is a wide difference in different persons with regard to the quantity and nature of the hair and the changes occurring in it during life. There are whole families in the members of which the hair begins to turn grey already soon after 20 or 30, while in other families the hair retains its original colour up to 60 or 70 or even 80 or the end of life. Similar is the difference with regard to the *loss* of hair, which commences in some families before 25, while members of other families retain their hair up to the most advanced age. The mere change of colour in itself exercises, especially when it is due to a family peculiarity, no influence on

health, but it is sometimes connected with permanent or transitory changes in more vital parts of the body ; the rapid change from the natural colour to greyness or whiteness, when it is not the effect of acute disease, is not rarely caused by a deterioration of the whole constitution, and thus requires the serious attention of the doctor. In many instances we are able to prevent the loss of hair or at all events to slacken the process of loss of hair, and to some degree also the change of colour, by always keeping the head cool and mostly uncovered, and sponging it regularly with cold water ; but a still more beneficial influence is exercised by daily *massage of the head*, which ought to consist not in mere rubbing of the hair and skin of the head, but in actively and rapidly moving the scalp to and from the bone, combined with a certain amount of pressure. By this kind of massage the nutrition of the entire scalp is promoted, including the nerves, the capillaries, the rete mucosum, the hair follicles, the sudoriparous and sebiparous glands. This massage, when properly carried out, exercises also a beneficial influence on the nutrition of the skull itself, and may thus somewhat counteract the tendency to atrophy of the parietal walls. This daily massage of the head,

which may be conveniently practised before bathing the head, checks also in some persons certain forms of headache. An additional advantage is that it entails a little exercise of the arms and hands which is apt to be neglected by persons who do no manual work. This remark applies also to other forms of self-massage.

XV.—Importance of the Glandular Organs and the Special Senses.

Considerable additions to our knowledge have been made during the last forty years by the attention paid to the functions of the *various glandular organs*, and especially the so-called *ductless glands*. What we know as yet is still very imperfect, but clinical observation and experiment have already clearly demonstrated that these organs exercise vast influence on the development, on the metabolism, and on the health of the whole organism. This has been clearly proved to be the case with *the thyroid and parathyroid glands*, with the *pituitary body* or *hypophysis* of the brain, and the *suprarenal glands*. The diseases and the extirpation of the thyroid and parathyroid glands produce remarkable changes in the whole body,

especially in the functions of the nervous, circulatory and cutaneous systems. As some morbid symptoms observed in old age seem to depend on pathological changes in these glands (Horsley [56 and 57], Ewald [40 and 41], Lorand [74] and others), we must endeavour to maintain them as long as possible in an effective state and avoid their atrophy. This consideration, and especially Kocher's observations on the removal of goitre, led me to begin many years ago regularly to massage gently my own thyroid and parathyroid glands, together with the larynx and the anterior part of the neck, and to advise many of my patients to do so. This practice has been attended with distinct benefit in several cases where symptoms akin to those of myxœdema had manifested themselves, such as puffiness of the face and hands, rapid falling out of hair, great dryness of the skin and mental hebetude. The massage of the thyroid and parathyroid region was gradually followed by the disappearance of these symptoms, and this without the assistance of thyroid extract. The involuntary muscular twitchings of the face and neck and actual convulsions which occur in some old people may possibly be due to senile changes in the parathyroid glands, and these, too, I have

seen checked more or less by gentle massage of the laryngeal region.

We are not able to massage the pituitary body and all the lymphatic and other glands of the body as thoroughly as the thyroid and parathyroid, because most of them do not lie so near to the surface. The glands situated in the abdominal cavity—the mesenteric glands, the spleen, the liver, the pancreas, the kidneys and suprarenal bodies—may to some degree be influenced by massage of the abdomen, but not sufficiently. Some beneficial influence also is effected by walking exercise, by the regular practice of abdominal pressure (p. 158), and by the respiratory movements which have been previously mentioned, when combined with thorough compression of the abdomen. More amenable to this mechanical treatment are the parotid and the submaxillary glands, which in some persons of advanced age lose their natural energy and secrete a viscid fluid instead of healthy saliva.

It is beyond the limits of this lecture to discuss the interesting field of organo-therapy.

As the human organism is one whole, in which every single organ is more or less intimately connected with the rest, the health of

the whole organism depends to some degree on that of every single part. Each single part ought, therefore, to be attended to for the benefit of the whole. It is, however, not in our power to do this efficiently. Thus the *special senses* which exercise great influence on the brain by the impressions which they convey to it, are apt to decay with advancing years, and our power to prevent this is very limited. By carrying out the rules for maintaining the energy of the circulation and nutrition of every single part of the body and preventing diseases, we exercise also some beneficial influence on the special senses; but still they are apt to become old and blunted. By judiciously using the eyes, and by avoiding overstraining them, as for instance by reading in a shaking railway train or in imperfect light, we can only somewhat prolong the energy of their functions and thus postpone one of the greatest inconveniences connected with old age.

XVI.—Prevention of Disease.

I have said before that *prevention of disease* is one of the principal means of prolonging life. A frequent source of disease is infection. This is generally known, but the duty of avoiding

exposure to infection is often neglected, even by most intelligent persons. I cannot enter here on the duty of the State and of the community to combat the spreading of infectious diseases; this is being more and more recognized and acted upon, but also every single individual ought to consider it his duty not to expose himself to infection, and, if himself infected, to avoid, as much as possible, every possibility of carrying infection to others. This duty ought to be acknowledged not only with regard to the graver diseases, but also those generally regarded as milder affections. Sir Lauder Brunton, in his suggestive address on "Longevity and the Means of Attaining it" [18], justly directs attention to the great infectiousness of common colds and the duty of evading as far as possible the communication of them to others, especially to those who are weak either from disease or from old age; for a so-called common cold, which most people consider a trifling matter, may under such circumstances, especially in very aged persons, become the cause of death. I have myself seen this repeatedly from common colds, and more frequently from influenza, which had been regarded as small matters.

One of the most important measures towards

the prevention of disease and of injurious habits, and also towards promoting healthful influences, is *education*. We all must hail the steps which are being taken in schools to promote a general knowledge of hygienic influences such as cleanliness, diet, exercise, and good air, but we must add to them the duty of imparting some elementary knowledge about prevention of disease and of spreading infectious diseases. A most necessary point in education is the teaching of temperance, especially with regard to alcoholic beverages, and the fearful consequences of intemperance, not only to the intemperate person himself, including the tendency to commission of crime, but also to the happiness and health of the family. Education, however, ought not to confine itself to the teaching of moderation and temperance, but ought to create *habits* for what is good and useful and suppress those of untruthfulness, carelessness, extravagance, procrastination, unpunctuality, self-indulgence, and of everything that is bad. Habits make or mar a man's life.

Amongst the important matters into which I am unable properly to enter is the *clothing*, which ought to cover the body without being too tight and too heavy, and ought to be varied

according to the season and the different meteorological conditions. It is essential to the maintenance of health, especially in very young children, old people, and all those whose vitality is lowered, to keep the skin warm; to the neglect of this rule many illnesses must be attributed. This is shown by everyday experience, and explained by Pasteur's experiments on fowls in relation to anthrax (p. 211). The clothing, however, ought not only to keep the body warm, but it ought to be arranged in such a way that it allows free movement to every part of the body, that it does not by pressure hinder the action of the organs of the chest and abdomen, as tight and badly arranged corsets do, or of the feet by badly fitting boots, or of the veins of the legs, as is done by tight garters, or of those of neck and face by tight collars, &c. Sir Frederick Treves has given valuable advice in his article "On the Influence of Dress on Health," in the "Book of Health" [126].

An equally important subject is the *house* or the rooms we live in, which ought to be light, airy and well ventilated, and ought to have a sunny aspect (*cf.* p. 22, footnote). On this matter we may refer to an article by Sir Shirley Murphy, "Health at

Home" [87], contained likewise in the "Book of Health."

Of great influence on the condition of the body is *climate*. This vast subject, too, we cannot adequately discuss. We must mention, however, that a regular "change" for six to eight weeks every year from one part of the country to another, or to the seaside, or to the Continent, to different elevations above the sea, is a great help to mind and body, and through this, a powerful agent in the prolongation of life. The exact choice depends on the condition of the individual; but a necessary consideration in this choice ought to be that the locality selected enables the aged person to be long in the open air and to take regular exercise. On some persons a stay at the seaside, or yachting, or a longer sea voyage, exercises the best influence; on others a stay in a warm and dry climate, such as Egypt; on others a fishing expedition; on others a walking tour; on others, a stay in mountainous districts at various elevations, combined with moderate climbing; on many persons the winter sports on the high Alps; for others, again, travel from one place of interest to another is preferable to a long stay at the same place. *Travelling* is, in

fact, a great promoter of longevity, especially by preventing premature senile decay. I am inclined to ascribe the benefit of travelling partly to the circumstance that the traveller is forced to change more or less his habits while travelling ; partly to the influence on the mind, to the diversion of his thoughts from himself and the daily worries to new things and matters of general interest. Old people whose mental activity begins to be stagnant ought to go to localities where their attention is stimulated by art, by history, by scenery, and by the manners of the people, such as Egypt, Rome, Naples, Palermo, Florence, Venice, Athens, Constantinople, London, Vienna, Paris, Munich, Berlin, &c., provided judicious care is taken to avoid chills and other injurious influences, and provided a moderate amount of resisting power is left.

It ought to go without saying that in travelling it is necessary to avoid draughts and dust in railway carriages ; and that at most foreign places one has to be on one's guard against the risks of infection from drinking water, from food, and from unhealthy habitations.

With increasing years the resisting power of the organism decreases, in some more and

in others less, in some earlier, in others later. While in youth and in the prime of life cold winters and the cold air of high elevations exercise a most bracing influence, and the dampness, the high winds, the fogs and mists of our ordinary winters are fairly well borne, they cause in many old people, especially those who neglect regular open-air exercise, and open windows by day and night, and also in persons weakened by disease, many ailments such as catarrhal affections, bronchitis, rheumatism, mental depression and other troubles, and through these lead to premature senile decay and death. Warming the dwelling-rooms, the passages of the house, the water-closets, and adopting warmer clothing are useful precautions, but are often insufficient to counteract the meteorological inclemencies. It is therefore prudent for many of those who have lost much of their resisting power, to spend the colder months in milder climates, where their accommodating powers are less tried, such as the south and south-west of England and Ireland, and still more so the French and Italian Riviera, especially the drier and more elevated regions, where, owing to the greater dryness of the air and the large proportion of sunshine, chronic

rheumatism, a frequent trouble of the aged, is much relieved, where the appetite, the inclination and power to take active exercise are increased, and through this the muscular, the circulatory and the digestive systems are maintained in a fairly vigorous condition. In the south-west of France, Pau and Arcachon have advantages, and also Biarritz, although it must be owned that it is rather too windy for the aged. In Spain, Malaga deserves to be mentioned. Egypt, Algiers, Madeira, the Canary Islands, and Corfu can only be recommended to those who, in spite of advanced years, have remained good travellers, and especially good sailors. The large amount of sunshine in these localities, the longer duration of daylight during the winter months, and the flowers, cheer the mind and render it more hopeful, and hope and cheerfulness exercise, we know, a most beneficial influence on the whole body. The first Lord Brougham showed his wisdom in this matter by spending the winters of his later life at Cannes, where he enjoyed much better health and prolonged his life considerably.

With regard to the injuriousness of *cold*, *i.e.*, low temperature of the air, slight, when combined with stillness of air, but great when

combined with wind, Sir Lauder Brunton directs attention to an ingenious experiment by Pasteur, "who discovered that fowls, the natural temperature of whose body is nearly 104° F., are immune from anthrax, but if they are made to stand with their legs in cold water until their temperature is sufficiently lowered, they become susceptible to the disease." We know that we often carry with us in the mouth, in the nose, and in other parts of the body, the germs of diseases, without becoming actually infected by the diseases themselves, while we are in robust health, but when our vitality is lowered by exposure to cold, or other injurious influences, we become apt to take the disease. Our experience of every day shows this especially with regard to pneumonia, influenza—so-called "colds," &c. We know also, from numerous observations, that persons feeble by age, or preceding disease, or weak constitution, are depressed in their assimilating, nervous and muscular functions, by continued low temperature, and under these circumstances frequently fall victims to pneumonia. Pasteur's just cited experiment explains this.

XVII.—Recapitulation.

There are many other subjects which deserve discussion, but I have already transgressed the limits of time, and I trust that, if the suggestions I have ventured to make are acted upon, with adaptation to the different conditions of persons and environments, the life of the individual will be prolonged, and that in the course of generations a habit of living judiciously will be created and transmitted from parents to children, and that the duration of human life will gradually be raised in a much larger number of cases to its normal term, viz., about 100 years; and I further hope with Sir J. Crichton-Browne, Professor Metchnikoff, Sir Lauder Brunton and others that not only the duration of life but also its usefulness will be prolonged, its happiness increased, and terminated by natural old age and death coming sleep-like without suffering. The pessimistic view so often expressed, that the human race is deteriorating, will be disproved; the type of man will, on the contrary, be raised physically as well as morally.

I will close this discourse by summing up some of the most important points more fully discussed in the body of the lecture :—

(1) To maintain the vigour of every organ, and the resisting power of the whole body by regular daily walks, rides, respiratory and other exercises.

(2) To spend daily several hours in the open air, and keep the air in the house pure and dry and moving by open windows and fire-places and other means.

(3) To practise moderation in eating, drinking, and all bodily enjoyments.

(4) To prevent disease and to counteract the inherited tendencies to various diseases (pp. 19 ff.).

(5) To create, as far as possible, the habit of going early to bed, and of rising early, and to restrict the hours of sleep, in adult life, to six, or seven, and only exceptionally eight (pp. 185 ff.).

(6) To promote a healthy condition of the skin by daily baths or ablutions (pp. 194 ff.).

(7) To keep the mental faculties in regular occupation by appropriate work (pp. 161 ff.).

(8) To cultivate sympathy, equanimity, contentedness, cheerfulness and hopefulness, and the great power of the will towards pursuing the path of duty and controlling anger, vanity, envy, jealousy, undue ambition, and all other passions (pp. 171 ff.).

Shakespeare puts some of these rules into the mouth of the old servant Adam in "As You Like It" :—

"Though I look old, yet I am strong and lusty ;
For in my youth I never did apply
Hot and rebellious spirits in my blood,
Nor did not with unbashful forehead woo
The means of weakness and debility,
Therefore my age is as a lusty winter,
Frosty, but kindly."

Act II, *Sc.* 3.

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